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SPECIAL REPORT

OF THE

EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS

RELATIVE TO

A COMPREHENSIVE MANAGEMENT PLAN

FOR THE

ADMINISTRATION OF SLUDGE TREATMENT IN THE COMMONWEALTH

October 31, 1980

Submitted
February, 1981

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Special Report to the Legislature

on

Comprehensive Sludge Management in the Commonwealth

October 31, 1980

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SPECIAL REPORT TO THE LEGISLATURE

on

COMPREHENSIVE SLUDGE MANAGEMENT IN THE COMMONWEALTH

October 31, 1980

Submitted by the

EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS

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EXECUTIVE SUMMARY

This report addresses the issue of comprehensive management of wastewater sludge, the residual material, solid or semisolid, removed from wastewater as a part of the treatment process. Included in the report are: a discussion of the institutional and regulatory framework for sludge management at both the state and national level; statistics for sludge generated by publicly owned treatment facilities in Massachusetts; an analysis of sludge disposal management issues and problems including examples of select community problems; and a description of corrective measures which have been implemented and which need to be initiated.

Disposal of sludge produced by wastewater treatment facilities has become an issue of increasing concern. This situation has been created primarily because of the effectiveness of the federal water pollution control program which since 1972 has provided funds for the construction of public wastewater treatment facilities as a means of abating the discharge of pollutants into the waters of the country. Not only has the federal program resulted in the construction of more wastewater treatment facilities, but it also has required that these facilities provide a higher level of treatment and thereby has resulted in the generation of increased quantities of sludge.

The problem of sludge disposal is complicated by the nature of sludge itself. It is a residue produced by the treatment of wastewater, but its disposal impacts other environmental jurisdictions - land, air, and water, both surface and subsurface. In addition, sludge has potential as a resource material, either using its nutrient value for agricultural purposes or its organic content as a source of energy. A management program must be comprehensive enough to address all environmental impacts and to encourage resource use when feasible.

Conventional methods for disposal of wastewater treatment plant sludge are landfilling, ocean disposal and incineration, the latter actually being a reduction process prior to landfilling. However, in the past five years or so these conventional disposal methods have become less feasible. There are two major reasons for this change:

1. The availability of sites for landfilling has become limited by demographic changes and by public attitudes to such land uses.
2. Federal environmental legislation has resulted in more stringent regulation of landfilling, land spreading, and air pollution and in the phasing out of ocean dumping.

The limitations placed upon conventional disposal methods have resulted in the development of alternative solutions to sludge disposal. This development was supported and encouraged by amendments to the Federal Water Pollution Control Act which Congress incorporated in the Clean Water Act of 1977. This 1977 legislation additionally recognized the need for regulating sludge disposal and utilization practices so that they would not adversely impact the environment. Such a provision was particularly important because the 1972 federal legislation did not include adequate requirements concerning sludge disposal and utilization and as a result many new or upgraded wastewater facilities were built without proper sludge disposal plans.

In Massachusetts, the effects of these inadequate disposal requirements resulted in a range of problems, some of which were exacerbated by the economic and land use changes which occurred in the interim between project planning and implementation. An example of one of the most serious problems caused by sludge disposal occurred at the South Essex Sewerage District where the lack of a sludge disposal site as well as problems with the operation of the sludge incinerator have forced the treatment facility to be inoperative for a period which may last as long as three years. At the other end of the spectrum is a facility such as the one in Sunderland which has turned to land application of sludge for fertilizer purposes because of the inability of the sludge drying beds to accommodate all the sludge produced by the facility.

Another federal legislative action impacting sludge disposal was the passage of the Resource Conservation and Recovery Act (RCRA) in 1976. This Act, which regulates solid and hazardous waste disposal practices, includes wastewater treatment sludge in its definition of solid and, when applicable, hazardous wastes.

Disposal and utilization of non-hazardous sludge from publicly owned treatment works (POTW's) must comply with the standards for land-filling and landspreading set forth in the EPA's Criteria for Classification of Solid Waste Disposal Facilities and Practices, which were co-promulgated under RCRA and the Clean Water Act. Hazardous sludge (sludge failing a leaching test or exhibiting specified characteristics) is subject to the RCRA hazardous waste regulations which provide for "cradle to grave" control.

Massachusetts has 114 publicly owned wastewater treatment facilities presently in operation, and it is estimated that more than 6,000 tons of sludge are generated daily. From 1972 to 1979, Massachusetts has received

more than $900 million in federal construction grants for wastewater treatment projects, which is estimated to have created 45,000 jobs. An additional $200 million is expected to be granted for such projects in 1980 and 1981, creating 1,000 more jobs. It is obvious from these figures that Massachusetts has profited economically as well as environmentally from the federal construction grants program. However, it should be understood that funding is conditional upon EPA and State approval of plans for wastewater treatment facilities, which must include provisions for the disposition of sludge in accordance with federal regulations. Since these regulations are comprehensive, particularly in terms of compliance with other environmental programs such as air, solid waste, and drinking water, it is important that Massachusetts policy and regulatory programs conform to the federal standards to avoid difficulties in obtaining construction grants funding.

In Massachusetts, issues pertaining to sludge management and regulation fall within the jurisdiction of the Executive Office of Envrionmental Affairs (EOEA) and the departments within the environmental secretariat. The Executive Office and its departments have recognized the need to develop a comprehensive approach to policy, program planning, and regulation since the late 1970's. In 1975, the Secretary established the Organic Recycling Commission which included in its work two studies pertaining to sludge utilization: one study addressed the feasibility of using sludge for fertilizer purposes on agricultural land and the second one examined the opportunities and potential for composting in Massachusetts. In 1977, the first step in establishing a management policy was taken when the Secretary and environmental commissioners adopted a statement of sludge management principles which set forth a policy of reuse and of resource

conservation. This sludge policy and its implementation has been continued under the present Secretary and enviromental commissioners.

Responsibility for various aspects of sludge policy, management planning, and regulation is divided among several agencies within EOEA:

1. The Department of Food and Agriculture is interested in utilizing the potential of sludge as a fertilizer or soil conditioner in a manner which benefits the State's agricultural community and which safeguards against soil or plant contamination.
2. The Department of Environmental Management, through its Bureau of Solid Waste, assists communities in solving solid waste problems and is responsible for state solid waste planning activities. The Bureau has included consideration of co-disposal of sludge and solid waste in its planning for some of the regional resource recovery facilities.
3. The Environmental Impact Review Section within EOEA evaluates the environmental impact of certain state activities. Under its regulations, 301 CMR 10, an Environmental Notification Form must be submitted for: any sewage sludge incinerator, plans to dispose of more than 15 wet tons of sludge per day, new publicly owned treatment works (POTW's), POTW's upgraded to a certain extent, and any POTW capacity increases.
4. The Metropolitan District Commission is involved in finding an alternative to its present practices of discharging sludge in Boston Harbor.
5. The Department of Environmental Quality Engineering, as the state's environmental regulatory agency, bears major responsibility for the regulation and control of sludge disposal and utilization. The following list describes the Divisional responsibilities for sludge regulation within the Department.

a. The Division of Water Pollution Control (DWPC) administers the federal construction grants program for wastewater treatment facilities; establishes and monitors water quality standards; grants pollutant discharge permits in conjunction with EPA under the National Pollutant Discharge Elimination System; approves privately owned wastewater treatment facilities of a certain size; and approves community pretreatment plans. On a regional basis, DPWC Regional Engineers monitor water quality programs, including the operation and maintenance of wastewater treatment facilities; they refer any sludge disposal problems which they find to the DEQE Regional Environmental Engineers.

b. The Division of Air Quality Control regulates emissions from sludge incinerators.

c. The Regional Environmental Engineers (REE's) are responsible for administering and enforcing all DEQE regulatory programs on a regional basis. The regional offices review and approve all sludge disposal and utilization plans as well as enforce regulatory programs associated with such practices.

d. The Division of Hazardous Waste (DHW) has responsibility for developing and implementing regulations and policy concerning all activities pertaining to disposal or utilization of residual materials, hazardous or non-hazardous, and thus has jurisdiction over wastewater treatment sludge utilization or disposal activities which might adversely impact the environment.

e. The DEQE Planning Section is responsible for the 208 regional water quality planning program. Many of the regional 208 water quality management plans include analysis of sludge disposal

problems and recommendations for control of pollution caused by them. The 208 program has also received EPA grants to address sludge management issues and to fund several regional sludge studies.

The division of responsibility has created problems in the development and implementation of a comprehensive sludge management program. However, recently steps have been taken to rectify these difficulties.

In regard to organization and procedure, a major step facilitating implementation of a comprehensive sludge disposal management plan was taken by the Legislature's enactment of Chapter 511 of the Acts of 1980 which made possible the integration of the Division of Water Pollution Control into DEQE. In addition, the following measures have been taken within EOEA:

1. The DEQE Commissioner has assigned to the Division of Hazardous Waste (DHW) responsibility for the regulation of non-hazardous as well as hazardous materials and thereby has centralized, in one division, jurisdiction for all residuals, including sludge. This organizational structure assures that within DEQE residual disposal and utilization programs are developed and implemented in a coordinated and consistent manner.

2. Within DHW specific responsibility for sludge has been delegated to the Sludge Program Coordinator's position in the Division's Planning and Program Development Branch. The role of the coordinator is to develop, in conjunction with other agencies with sludge responsibilities, sludge disposal and utilization policies, regulations, and management programs; to function as a clearing center for problems and information on sludge; and to facilitate demonstration and research projects pertaining to sludge disposal and utilization. Much of this work, particularly that concerning policy and regulation

development, is accomplished through the interagency Sludge Task Force, which the Sludge Program Coordinator chairs. This group consists of representatives of U.S. Environmental Protection Agency, U.S. Geological Service, the Department of Public Health, the Department of Food and Agriculture, DEQE Regional Environmental Engineer, DEQE-DWPC Construction Grants Program staff, DEQE-DHW solid waste staff, DEQE legal staff, and DEQE Planning Office.

3. Within DWPC Construction Grants Program staff, responsibility for all sludge related issues has been assigned to the Sludge Specialist, a regular staff member who additionally serves as sludge liaison with other programs; trouble shoots any project problems resulting from sludge handling, disposal, and utilization; and serves as information center and clearing house for the rest of the Construction Grants Program staff.

4. Coordination between wastewater treatment facility projects funded under Construction Grants Program and other programs has been improved by DWPC's development of a Review Procedure List which specifies junctures at which review and comment by appropriate staffs of other agencies should take place. This Procedure List will also include criteria for the sludge management component of plans for wastewater treatment facilities in order to assure that they are formulated and reviewed in accordance with a consistent set of standards.

In regard to policy and regulations, the following steps have been taken:

1. DEQE has developed a residual disposal and utilization policy for sludge and septage which clarifies and simplifies its regulatory program for such

materials. This policy formalizes the fact that sludge disposal is an integral part of wastewater treatment - that the continued operation of a treatment facility is jeopardized when there is no resolution of the sludge disposition issue. Under DEQE's policy, non-hazardous wastewater treatment sludge disposal is regulated under G.L. Chapter 83 Section 7 which authorizes DEQE to order communities to properly operate and maintain sewage treatment plants and under G.L. Chapter 21, Sections 27(9), 27(12) 33D, 34, and 43, which authorize DEQE's Division of Water Pollution Control to regulate sewage treatment plants. Resource use of sludge is regulated under the various statutes giving DEQE authority to protect the air, water, and land from pollution (G.L. Chapters 21 Section 27(12); 111, Sections 142 A-J; 111, Section 160; and 131, Section 4). All hazardous sludges are subject to G.L. Chapters 21C, 21D, and 111, Section 150B, except for hazardous sludge generated by an NPDES permitted facility which is stored, treated, used or disposed of on the site of such a facility. This sludge is regulated under Chapter 21, Section 43.

2. Sludge and septage land application regulations have been completed. After public review of the draft, hearings will be held in the early summer of 1981 on the proposed regulations. DEQE is also in the process of drafting composting and sludge landfilling regulations.

The successful completion of a comprehensive sludge management program in Massachusetts is contingent upon continued development and administration of a sludge management program which is broadly based and which interrelates with other regulatory and resource management programs. In order to

accomplish this goal, it is important that the following occur:

1. EOEA should continue to oversee policy development and assure that the agencies within the environmental secretariat pursue a uniform policy in regard to sludge disposal and utilization.

2. Management of the regulatory program should continue to be centralized in the Division of Hazardous Waste where coordination with other environmental regulatory programs can take place. It is important that the coordination responsibilities continue to extend outside the purely regulatory framework to sludge related planning, resource management, and construction grants activities in order to assure a comprehensive and consistent management program. Such coordination is particularly needed with:

   a. The DWPC Construction Grants Program to assure that projects are not jeopardized or delayed because of difficulties with sludge disposition;

   b. The Bureau of Solid Waste in the development of the state's Solid Waste Plan and in the planning of regional resource recovery facilities, with special consideration given to the feasibility of regional sludge disposal or utilization solutions and to co-disposal of sludge and solid waste;

   c. The Department of Food and Agriculture and the Cooperative Extension Service in the development and implementation of land application projects.

3. Weak links in the chain of interrelated programs and regulations need to be strengthened. In particular:

   a. The planning, construction and supervision of wastewater treatment facilities, both publicly and privately owned, should continue to be closely coordinated with other programs

with sludge management and regulation responsibilities. A more clearly defined review procedure needs to be developed in order to assure close coordination by both the DEQE Regional Environmental Engineers and the DWPC Regional Engineers with the Construction Grants Program.

b. A formal procedure should be established for reviewing disposal plans for non-hazardous sludge generated by privately owned facilities either treating wastewater to comply with an NPDES permit or pretreating prior to discharge into a sewer.

c. A better data base and reporting system concerning sludge qualities, amounts, and disposal/utilization practices needs to be established. At present this information is not always available for many of the state's wastewater treatment facilities, and when it does exist, it is not readily obtainable.

d. Laboratory capability needs to be developed in order to facilitate analysis of sludge and of soils when sludge is to be land applied. The Lawrence Experiment Station needs increased resources in order to assume additional responsibility of sludge analysis for DEQE. Regional use of laboratories in wastewater treatment facilities should be encouraged in order to avoid duplicating expensive equipment and operation whenever feasible.

The problems of developing and implementing a comprehensive sludge management program are somewhat similar to those of other residuals wastes but with some significant differences. Wastewater treatment sludge falls within the jurisdiction of several environmental programs, the major two being water pollution control and solid waste. Sludge management also involves several

facets, the prime ones being the regulation of sludge disposal and utilization; state and federal funding of wastewater treatment facilities; and resource recovery through land application, co-disposal, and other energy generating solutions. A comprehensive management approach is important to the Commonwealth not only for environmental but also for economic reasons. At stake are grants for constructing wastewater treatment facilities, industrial and construction activities, resource recovery, agricultural development, and alternative energy sources as well as the protection of the Commonwealth's air, land and waters. It is hoped that this report clarifies the issues involved with the development of an effective management program and that the Legislature, in its wisdom, will use the report as a resource tool either for future studies or for legislative decisions.

SPECIAL REPORT

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COMPREHENSIVE SLUDGE MANAGEMENT

in the

COMMONWEALTH
October 31, 1980

Submitted by the

EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS

February, 1981

1. Introduction

The term sludge refers to the residues produced by various processes in which solid particles are separated out of an effluent stream. These processes are varied. Sludge is produced by industrial manufacturing processes; by air emissions control facilities; by treatment facilities which remove impurities from drinking water; and by wastewater treatment facilities which remove pollutants to produce a discharge which meets specific water quality standards. This report addresses only the management of the latter type of sludge - that which is generated by wastewater treatment facilities.

2. Problem Definition

Sludge generation is an integral function of wastewater treatment. Conventional methods for disposing of sludge have been landfilling,

incineration, and ocean dumping. Developments in recent years have limited the availability of these disposal options and have led to the initiation of alternative approaches to the disposition of this residual material. These changes also have created the need for the institution of a comprehensive management system which assures that adequate disposal options are available and are carried out in a cost-effective and environmentally safe manner.

The problem of sludge disposal has been heightened as a result of the successful water pollution abatement program initiated by the 1972 amendments to the Federal Water Pollution Control Act, Public Law 92-500. Established as a part of this Act was a grant program to fund the construction of publicly owned treatment works (POTW's) in order to assist communities in achieving water quality goals. The result of this federal Construction Grants Program has been the upgrading of existing POTW's to a higher level of treatment and the construction of many new treatment facilities. The increase in the amount of sludge generated from these improved and additional treatment facilities is one of the major causes of the disposal problem.

Another cause is the fact that traditional disposal options are no longer as feasible as they were in the past. This is because:

- Ocean dumping is being phased out and will not be permitted after December 31, 1981, as a result of the 1977 Amendment to the Ocean Dumping Act, P.L. 95-153;
- Landfill site availability has been limited by demographic changes and by public attitudes to such land use;
- Landfilling and land spreading are subject to more stringent regulations such as those resulting from the Resource Conservation and Recovery Act (RCRA), P.L. 94-580; and

- Sludge incineration has become more costly and more difficult because of rising fuel costs and the need for air pollution control devices to meet air quality standards set by the Clean Air Act, P.L. 95-95, as amended.

Effective regulation and management is complicated further by the nature of sludge itself. Sludge does not obey the boundaries of authority of existing regulatory and planning agencies because it passes from one environmental jurisdiction to another during each stage of its generation and disposal. Sludge is a product of the water pollution control process; however its final disposition can impact air quality, soil crops, ground water, and surface water. The physical character of sludge can range from liquid to dry; and its quality can vary from that of a nutrient rich, soil conditioning resource material to that of a toxic waste.

The 1972 Water Pollution Control Act provided only that sludge should be disposed of in an environmentally sound manner and that any pollutant entering a navigable water from sewage sludge disposal was prohibited without an EPA permit. This limited approach to sludge management was reflected in the federal Construction Grants Program. Its major emphasis was on water pollution abatement; insufficient consideration was accorded to sludge disposal and its impacts on land, air, and water resources. No provision was made to link water pollution control programs institutionally and programatically with other environmental programs.

Not only was inadequate consideration given to the problems of sludge disposal, but the funding for the Construction Grants Program was set up in a manner to encourage expeditious processing of grant applications. States' grant allocations had to be obligated to specific projects within 24 months or the unobligated funds reverted to a national pool. Since

these funds not only aided states in eliminating water pollution problems but also benefited them economically by providing jobs and stimulating growth, there was great incentive for each state to obligate all their available funds. Since sludge disposition was not viewed by those processing grants applications as a major step in the grants approval process, many projects were approved which had inadequate or deficient sludge management plans.

Mid-course corrections to the water pollution abatement program were made in 1977 by the Clean Water Act (CWA), P.L. 95-217, which amended the 1972 legislation. These amendments resulted in greater emphasis being placed on both the adequacy of the sludge management plan for construction grants projects and on the use of new sludge technologies, particularly those which entail resource utilization or recovery and energy efficiency and conservation.

The amendments made in 1977 also enabled Congress to restructure the water pollution control program to take into account the other environmental programs which came into being subsequent to 1972. Looking at their chronology, it becomes evident that one of the causes of the sludge disposal problems resulting from the 1972 legislation was the timing of the other environmental regulatory programs:

1974 New Source Performance Standards - Regulations promulgated under the authority of the Clean Air Act which set emissions standards for sludge incinerators.

1974 Safe Drinking Water Act - Set national standards to protect ground and surface drinking water supplies from health hazards.

1976 Resource Conservation and Recovery Act - Requires that solid wastes be utilized or disposed of in a safe and environmentally acceptable manner and includes sludge from wastewater treatment facilities in its definition of solid waste.

1977 Amendments to Marine Protection Research and Sanctuaries Act -

- **Prohibit disposal of sludge in the ocean after December 31, 1981.**

The net result of this sequential legislation has been to shift the problems of sludge disposal from one environmental medium to another until all the media are restricted.

3. Federal Legislative and Regulatory Policy

As indicated in the preceding section, federal legislation and regulatory policy are major determinants in the development of a state's sludge management program. The federal program has been evolving since 1972. The major legislative and regulatory provisions pertaining to sludge are described below. (See Appendix A-1 for a chronological listing.)

a. Clean Water Act of 1977 contained several provisions which made substantive changes in the area of sludge management. The provisions had two major objectives:

- To assure adequate protection of public health and the environment by promulgation of minimum standards for sludge disposal and utilization; and
- To maximize encouragement of beneficial uses of sludge which conform to federal standards.

Environmentally **sound** disposal practices are encouraged as a result of the provisions of the CWA of 1977 requiring EPA to develop regulations providing guidelines for the disposal and utilization of sludge. The Act further stipulates that the owner or operator of a POTW is legally obligated to dispose of sludge in accordance with such regulations. Another provision concerning proper sludge disposal is one that requires an NPDES permit for any pollutant from sewage sludge entering navigable waters, thereby more clearly linking disposal with the water pollution abatement program.

Beneficial utilization of sludge is encouraged in several ways by the Act. First, the pretreatment program provisions specifically tie the removal of toxics to the ability of a POTW to meet EPA sludge disposal and utilization guidelines. This relationship is further clarified in EPA's Pretreatment Regulations of June 26, 1978, which define the term "Interference" as including the prevention of sewage sludge usage or disposal in accordance with the usage/disposal guideline regulations. In addition, the Pretreatment Regulations stipulate that revision of pretreatment standards can occur only under certain conditions, including compliance with the disposal/utilization guideline regulations, RCRA, the Clean Air Act, and Toxic Substance Control Act. Under the National Pretreatment Strategy, Appendix A of the Pretreatment Regulations, any pollutant which contaminates sludge, and that includes interference with sludge landspreading, must be removed by pretreatment. EPA has also decided that in determining the best available technology (BAT) economically feasible for industrial users of POTW's, it will not consider the level of pollutant removal which a POTW may achieve, since such removal may preclude reuse of sludge. This means that the BAT pretreatment standards will be more stringent for industries because they will not be able to include the POTW's treatment capability in their calculation of BAT.

Secondly, the Act encourages beneficial utilization of sludge through the innovative and alternative technology provisions. Innovative and alternative technology was explicitly encouraged in the 1972 legislation, but the CWA of 1977 strengthened this provision by requiring every community seeking federal construction grant funds to evaluate innovative and alternative techniques and

processes in its facilities plans. These technologies are defined generally as those which foster recycling and reuse of water and waste materials, such as sludge; energy conservation and recovery; and cost reduction. Land application of sludge, composting, energy recovery,and codisposal with solid waste are some of the sludge disposal solutions which fall within the the innovative and alternative (I/A) technologies program. In addition, the Act provides financial incentive for these technologies. Projects with innovative and alternative technologies are eligible to receive grants covering 85% of the federal share of the project. The state share for such projects is 9%, with the remaining 6% paid by the locality. Such projects are also given a 15% bonus in the calculation of cost effectiveness analysis in comparison to conventional methods. This means that I/A technologies that may cost up to 15% more than conventional technologies may be funded. There is provision for 100% grants funding for the cost of replacement or modification should these technologies fail.

EPA is implementing these statutory requirements through the promulgation of regulations, transfer technology publications and seminars, and process design manuals. (See Appendices A-1 to A-3 for detailed listing). The Pretreatment Regulations and the Construction Grants Regulations spell out in detail steps which must be followed by POTW's. Pre-proposal Draft Regulations, issued in May, 1980, address one aspect of sludge utilization, the distribution and marketing of sewage sludge products, and are intended to provide adequate safeguards for protection of public health and the environment when sludge use is outside the control of the POTW.

EPA is also addressing the problem of integrating sludge disposal with other environmental regulatory programs. It has decided to promulgate in the future a comprehensive set of regulations for sewage sludge management which will incorporate regulatory provisions of other statutes relating to sludge.

b. RCRA is the second major statute which affects sludge disposal because sludge is included in its definition of solid waste. The two provisions affecting sludge disposal are the program to eliminate open dumping and the hazardous waste regulatory program. Under the former program, EPA has issued Criteria for Classification of Solid Waste Disposal Facilities and Practices, September 21, 1979, to guide states in determining which solid waste disposal facilities are sanitary landfills and which ones are open dumps. The Criteria which apply to all solid wastes, including sludge, cover land disposal and application to land used for the production of food chain crops. EPA co-promulgated these regulations under the statutory authority of RCRA and CWA as partial fulfillment of the sludge disposal and utilization regulations. The Criteria set standards pertaining to floodplains, endangered species, surface water, and ground water, and they establish heavy metals limits and pathogen reduction procedures which must be followed for land application of solid waste for food crops. Since POTW's are legally bound to follow the disposal and utilization guideline regulations issued under CWA, these Criteria are mandatory for POTW sludge disposal and utilization.

Sewage sludge is also covered by the Hazardous Waste Regulations promulgated by EPA on May 19, 1980. Sludges, including those from POTW's, are subject to Hazardous Waste Regulations if they exhibit

any of the four following characteristics: ignitability, corrosivity, reactivity and toxicity as determined by an EPA specified extraction procedure test. These regulations require a cradle to grave manifest system and disposal in controlled sites designated for hazardous waste.

These RCRA regulations will apply to sewage sludge until sometime in the future when EPA promulgates its set of comprehensive regulations to deal with sewage sludge management. At that time, sewage sludge will no longer be subject to the Hazardous Waste Regulations per se but will be regulated by a separate set of regulations which incorporate the appropriate RCRA Hazardous Waste Regulations.

4. Sludge Management in Massachusetts

a. Policy: In December, 1977, the Secretary of Environmental Affairs and her Commissioners adopted a statement of sludge management principles which sets forth a policy of reuse and resource conservation. (Appendix B.) In addition, in March, 1978, the Secretary and her Commissioners accepted as the technical basis for sludge policy implementation two reports of the Organic Recycling Commission. The first report, The Feasibility of Application of Municipal Sewage Sludge on Agricultural Land in Massachusetts, concluded that this recycling practice was feasible under certain conditions and set forth constraints for safeguarding public health, agriculture, and the environment. The second report, Opportunities for Composting in Massachusetts, described the potential for composting and outlined areas where further research was needed. This sludge policy and its implementation has been continued under the present Secretary of Environmental Affairs and the Commissioners within the Secretariat.

b. Institutional Framework: Primary responsibility for sludge management in Massachusetts lies with several agencies and levels of government:

1) The Executive Office of Environmental Affairs is responsible for setting overall policy and overseeing implementation by the departments within the environmental secretariat.

2) The Department of Environmental Quality Engineering (DEQE) as the Commonwealth's environmental regulatory agency has jurisdiction over sludge through the Commissioner's office and several of its Divisions.

a) Division of Water Pollution Control (DWPC) is directly involved with sludge management through its administration of the Construction Grants Program authorized by Section 201 of the CWA. Section 201 (d) (4) of the CWA states that wastewater treatment facilities should provide for the "ultimate disposal of sludge in a manner that will not result in environmental hazards." EPA Construction Grants Regulations in Section 35.917-1 (6) (40 CFR, Part 35, October 1, 1978) require the inclusion of a plan for the management and disposal of sludge in municipal wastewater facilities plans. Thus, it is the responsibility of the DWPC Construction Grants staff to make certain that any plans it approves for a publicly owned treatment facility must provide for the ultimate disposition of sludge in an environmentally sound manner.

DWPC also has responsibility for the regulation of certain categories of private wastewater treatment facilities. The two areas which involve sludge managment are the National Pollutant Discharge Elimination System permit (NPDES) and the industrial pretreatment programs.

(1) The NPDES permits are issued jointly with EPA for the

discharge of treated wastes into surface waters by all municipal, industrial, and all other sources such as commercial establishments, institutions, and residential complexes. Not only does DWPC issue the NPDES permit jointly with EPA, but it also approves plans for private treatment facilities built to meet the conditions of an NPDES permit. As a part of this review and approval process, DWPC requires that sludge disposal methods be developed and that they receive approval from the other appropriate authorities, including DEQE Regional Environmental Engineers and local boards of health, before DWPC approval of the facility is granted.

(2) Municipal programs which are established to require industries to remove certain pollutants (pre-treat) from their wastewater prior to discharge into a public sewer system must be reviewed and approved by DWPC. Generally this approval is limited to the municipal plan but, in certain cases including all facilities formerly discharging to surface waters under an NPDES permit pending the completion of a municipal sewer system and for others at the request of the industry or local authorities, DWPC does approve the individual pretreatment facility.

Once plants are in operation, it is the responsibility of the DWPC Regional Engineers to make certain that the facilities are operated and maintained in a manner which assures that the discharge (effluent) meets water quality standards. If during the course of a routine inspection of a private treatment facility, a DWPC Engineer encounters what appears to be improper sludge disposal, a referral is made to the appropriate DEQE authority for follow-up action.

b) The DEQE Planning Office supervises the 208 Areawide Wastewater Management Program being conducted under authority of Section 208 of CWA. 208 plans contain an element that identifies sludge generation and disposal practices in order to determine the extent of regional sludge management problems. During 1980, the 208 program has funded a demonstration sludge land application project and a study of sludge management issues.

c) The Division of Air Quality Control is responsible for the establishment of air quality standards and as a part of its program regulates incinerator emissions, including those from sludge incinerators.

d) The Division of Hazardous Waste (DHW) regulates disposal and composting of solid wastes under the authority of MGL Chapter 111, Section 150A. Sludge disposed of in landfills is subject to solid waste landfill regulations. Regional DEQE Engineers must review and approve all landfilling, land spreading, and composting plans. DHW also regulates the disposal of hazardous waste and thus is responsible for sludge which DEQE deems to be of a hazardous nature or which meets EPA's definition of a hazardous waste. The licensing of hazardous waste haulers is included in this regulatory program.

3) The Department of Environmental Management (DEM) has jurisdiction over sludge through its Bureau of Solid Waste Disposal (BSWD) under the authority of its enabling legislation, Chapter 16, Section 18, which includes sludge in the definition of solid waste. The Bureau is primarily involved in the planning phases of solid waste management and assisting communities in

solving solid waste disposal problems. It has also been designated as the lead agency responsible for development of a state solid waste plan under Section 4002 of RCRA. Sludge is defined as solid waste in Section 1004 (27) of RCRA.

4) Local boards of health play a major role through their powers for site assignment of sanitary landfills and for authorization for disposal of special wastes in a sanitary landfill.

In addition, there are several other agencies which play a secondary role in sludge management.

1) The Department of Food and Agriculture has no regulatory authority over sludge. It supports the use of sludge when appropriate as a fertilizer or soil conditioner. Where sludge disposal practices would not pose risks to the food chain, land application would aid agriculture development in the Commonwealth. The Department can play a role in identifying state-owned land that is suitable for land application.

2) The Environmental Impact Review Section within the Executive Office of Environmental Affairs evaluates the environmental impacts of certain state activities as defined in the Massachusetts Environmental Policy Act (MEPA), MGL Chapter 30, Sections 62-62H. These are detailed in the MEPA regulations, 301 CMR 10, and include any sewage sludge incinerator, plans to dispose of more than 15 wet tons of sludge per day, new POTW's, POTW's upgraded to a certain extent, and POTW capacity increases.

3) The Lawrence Experiment Station of DEQE provides laboratory support services, including sludge analysis, for DEQE.

4) The Wetland Division in DEQE develops policies and regulations concerning wetlands protection as authorized by the Wetland Protection Act, MGL. Chapter 131, Section 40. These regulations cover disposal of sludge for all purposes in a wetland or

within 100 feet of a wetland.

5) Local Conservation Commissions have responsibility for administration and enforcement of the Wetlands Protection Act in their communities.

To overcome this dispersed responsibility, the Secretary of Environmental Affairs has concurred with the DEQE Commissioner's establishment of a sludge program coordinator position within the DHW. The role of the coordinator is to develop policy regulations, and management programs in conjunction with all agencies which have some responsibility for sludge and to function as a clearing house for problems and information on sludge. The coordinator chairs the inter-agency Sludge Task Force which consists of permanent representatives from the Division of Water Pollution Control Construction Grants Staff, DEQE Planning Office, DEQE Regional Environmental Engineers, the Division of Hazardous Waste, Department of Food and Agriculture, Department of Public Health, EPA Solid Waste Section, and ad hoc representatives from other staffs and agencies, depending upon the issues being addressed.

c. Massachusetts Regulatory Program

1) Sludge from POTW's has been regulated by the DEQE under the authority of two statutes:

a) Chapter 83, Sections 6 and 7:

Sludge disposed of on the site of a POTW has been regulated under Chapter 83, Sections 6 and 7. It has been the Department's interpretation that disposal of sludge is an integral part of the sewage treatment operation and that the public hearing held under Chapter 83, Section 6, concerning the designation of a site for sewage treatment, includes the use of the land for on-site disposal of sludge.

b) Chapter 111, Section 150A:

Sludge disposed of off the site of a POTW has been regulated under Chapter 111, Section 150A. Any off site disposal, therefore, has had to occur at a facility, such as a solid waste disposal facility, which received site assignment from the local board of health. In addition, since sludge, particularly in its liquid form (less than 18% solids), needs special handling when disposed of at a solid waste facility accepting other wastes, it has been subject to the Special Waste Section of the State Regulations for Disposal of Solid Wastes by Sanitary Landfill (310 CMR 19.16). This section requires authorization by the local board of health for disposal of a special waste at a solid waste facility.

2) Disposal of non-hazardous sludge generated by private wastewater treatment facilities also has been regulated under the authority of Chapter 83, Section 7 and Chapter 111, Section 150A.

a) Private wastewater treatment facilities which have been built to meet the conditions of a surface water effluent discharge NPEDS permit issued by the Division of Water Pollution Control in conjunction with EPA have been subject to regulation under Chapter 83, Section 7 of the MGL. One of the criteria for DWPC approval of plans for such facilities is that sludge disposal methods be developed and approved by other appropriate agencies. Though DWPC has no responsibility for assuring that sludge disposal is properly addressed on or off-site, if a DWPC engineer encounters what appears to be

improper disposal on-site during the course of an inspection, the matter is referred to the appropriate DEQE authority. Sludge disposal off-site in landfills has been subject to the provisions and regulations of Chapter 111, Section 150A, and thus have been within the jurisdiction of local boards of health and the DEQE Regional Engineers.

b) The regulation of the disposal of non-hazardous sludge generated by private industrial facilities built to treat wastewater prior to discharge into municipal sewer systems is not clearly delineated. In general, DEQE has responsibility over such disposal through its various environmental regulatory programs. (MGL Chapter 21, Section 27 (12); Chapter 111, Sections 142A-142J; and Chapter 131, Section 40). In theory every disposal plan should be reviewed and approved by the DEQE Regional Environmental Engineers. Hazardous sludge disposal is regulated through Chapter 21C, 21D, and 111, Sections 150B except for NPDES permitted facilities which are regulated under Ch. 21, §43. For non-hazardous sludge, however, there is no set procedure to assure that DEQE review does in fact take place. Responsibility for approval of private pretreatment facilities lies for the most part with the communities. There is no procedure existing which assures DEQE review of non-hazardous sludge disposal plans for such facilities.

Some pretreatment facilities, however, do come under the review of DWPC, and one of the criteria for the approval by DWPC of such facilities is the existence of a sludge disposal plan which has been approved by appropriate

state agencies, including DEQE, and by local authorities. DWPC reviews only a small percent of pretreatment facilities, and this occurs only:

(1) at the request of an industry or a community, or

(2) when an industry which has been issued an NPDES permit pending the completion of a municipal sewer system, applies to DWPC for a sewer connection permit.

3) Hazardous sludge is regulated by DEQE. Though DWPC has responsibility for regulating hazardous sludge from treatment facilities with NPDES permits and the Division of Hazardous Waste regulates hazardous sludge from all other facilities, a regulatory program is being established which will apply uniformly to all hazardous sludge. The statutory authority for the state's hazardous waste program is derived from:

a) Chapter 21C, as amended, which requires DEQE to develop a regulatory program to carefully track and stringently control hazardous waste from cradle to grave. This is to be achieved by licensing collectors, users, haulers, processors, and disposers of hazardous wastes, and by regulating hazardous wastes at the site of generation. In addition, all of these parties must comply with a manifest system which will track every movement of wastes from their generation to final disposal.

b) Chapter 21D sets up a procedure for siting facilities that provides for negotiation between prospective "host" communities and developers of hazardous waste facilities. Waste handling at the site of generation including treatment, storage, and non-land disposal are exempt from this process.

c) Chapter 111, Section 150B establishes a site assignment process for facilities treating, storing, and disposing of hazardous waste.

4) DEQE is in the process of reevaluating its sludge regulatory policy. Regulation under one statutory authority would be more efficient and effective and also would be consistent with the Department's on-going program of streamlining its regulatory procedures. The Department believes that the regulatory policy needs to be revised to strengthen the interfacing of water pollution control with other environmental programs, such as solid waste, air, water supply, hazardous waste, and wetlands. In addition, provision must be made for recent technological and procedural innovations, such as resource use of sludge, and for areas of increased concern, such as disposal of sludge from private facilities being constructed to comply with the pretreatment requirements of the Clean Water Act.

Massachusetts law is not clear in regard to disposal of sludge from wastewater treatment facilities. Sludge disposal is a vital part of the sewage treatment process. The continued operation of a sewage treatment plant clearly is jeopardized when there is no adequate and environmentally sound solution for the disposition of its sludge. Under MGL Chapter 83, Section 7, DEQE is authorized to order the owner or operator of any sewage treatment plant to enlarge or improve the works or change the operational procedure in order to efficiently purify and dispose of the sewage.

Chapter 111, Section 150A requires site assignment for any facility for the treatment or disposition of

refuse. "Refuse" is defined in the first paragraph of this statute, as most recently amended by Chapter 197, Section 4 of the Acts of 1978 as "all solid or liquid waste materials, including garbage and rubbish, sludge and residual waste, but not including sewage." This definition applies to only this section of the statute.

MGL Chapter 16, Sections 18-24 provide for the management of solid waste disposal by the Department of Environmental Management. Section 18, as most recently amended by Chapter 197, Section 1, of the Acts of 1978, defines sludge as "any solid, semi-solid or liquid waste generated from a municipal, commercial, or industrial wastewater treatment plant, water supply treatment plant, or any other such waste having similar characteristics and effect," and defines solid waste as "garbage, refuse, sludge....and other discarded material....but does not include solid or dissolved material in domestic sewage...." These definitions apply only to MGL Chapter 16, Sections 18-24 inclusive. Section 19 authorizes DEM to dispose of solid waste, including residual waste, in any manner concurred with by DEQE, with site assignment granted by DEQE, rather than by the local board of health as required by MGL Chapter 111, Section 150A.

Under Chapter 21, Sections 26-53, DWPC is authorized to regulate sewage treatment plants; and under Chapter 83, Section 7, DEQE is authorized to issue necessary orders for "the efficient purification and disposal of sewage."

These statutes can be construed to include disposal of sludge generated by a POTW since the statutes were clearly intended to give DEQE and DWPC authority over the entire treatment operation. Any other interpretation could leave those agencies without authority over this key part of the operation. This dilemma has been clearly demonstrated in the case of the South Essex Sewerage District where the plant has been forced to halt its treatment process as a result of its sludge disposal problems.

If sludge generated by a sewage treatment plant is refuse within the meaning of MGL Chapter 111, Section 150A, its disposition by anyone other than a state agency is subject to site assignment by the local board of health. This would allow the board of health to interfere with DEQE orders issued pursuant to MGL Chapter 83, Section 7. While municipalities have the authority to regulate or prohibit activity authorized or permitted by the State, they have no authority to regulate or prohibit activity mandated by the State. In order to prevent MGL Chapter 111, Section 150A from violating this principle and to make it consistent with MGL Chapter 83, Section 7, the definition of refuse in MGL Chapter 111, Section 150A should be interpreted to exclude sludge. Its disposition then would be subject to orders issued by DEQE pursuant to MGL Chapter 83, Section 7 without possible legal confusion resulting from regulation by the board of health pursuant to MGL Chapter 111, Section 150A.

To this end, DEQE has developed a policy statement which clarifies and incorporates in one document its regulatory policy for the disposal of sludge, septage, and other similar materials. Under this policy, all sewage sludge disposal, except that which is classified as a hazardous waste, is to be regulated under Chapter 21, Sections 27(9), 27(12), 33D, 34, and 43 and Chapter 83, Section 7. Disposal of all other non-hazardous wastes is to be subject to Chapter 111, Section 150A, except septage which is to be regulated under Chapter 111, Section 31(D). This policy also clarifies the regulatory approach to beneficial use of sludge, septage, and other similar materials. Beneficial use of such non-hazardous materials for such purposes as fertilizer or soil conditioners should be distinguished from disposal but needs to be regulated to assure that there is no risk to public health or the environment. DEQE and DWPC have authority under several statutes to prevent pollution of water, air, drinking water supplies, and wetlands. These statutes are Chapter 21, Section 27 (12); Chapter 111, Sections 142A-142J, 160; and Chapter 131, Section 40. Regulation of beneficial use is to be carried out under the authority of these statutes, except for septage which is to be regulated under Chapter 111, Section 31 (D).

All hazardous wastes whether disposed of or used as a resource material are subject to Chapters 21C, as amended, 21D, and 111, Section 150B.

d. Massachusetts Sludge Management Program

One of the major issues to be addressed in the development of the state sludge management program is the coordination with other environmental programs. The focal point for that coordination is the Construction Grants Program. Administration of this program for the construction of wastewater treatment

facilities, which is federally funded and therefore subject to specific federal regulation, has recently been taken over from EPA by the state. This program has been very important to Massachusetts' water pollution abatement program and to its economy. Since 1972, Massachusetts has received more than $900 million from the federal Construction Grants Program and will receive additional grants of $100 million for each year, 1980 and 1981. It is estimated that fifty jobs are created for each million dollars in grants, which means a total of about 45,000 jobs for Massachusetts from 1972-1979.

There are secondary impacts from the construction and operation of treatment works, such as sludge disposal, which primarily impact land, air, and groundwater quality rather than surface water quality. These impacts. especially sludge disposal, need to be considered as a part of the whole construction grant process, from the planning phase to the actual operation of the wastewater treatment facilities.

It is important that an administrative framework be established which assures that sludge management solutions are consistent with the objectives and with the regulations of other environmental programs. This issue is becoming more important as the Commonwealth embarks upon the inventory of solid waste disposal facilities for compliance with the RCRA Classification Criteria and develops its hazardous waste program. Coordination with hazardous waste also will be necessary, particularly in two aspects: 1) the hazardous waste regulations promulgated under RCRA which apply to sludge from POTW's; and 2) the implementation of the industrial

pretreatment programs required under the Clean Water Act. Implementation of this pretreatment program will produce greater quantities of potentially hazardous sludges from private treatment facilities.

Coordination with other programs is presently achieved in several ways:

1) Through the DEQE Regional Environmental Engineers (REE) who are responsible for administering and enforcing DEQE programs in four regions of the State:

   a) These engineers review facility plans, designs, and construction plans for construction grants projects. This review process enables the Regional Engineers to assure that proposed sludge disposal solutions comply with solid waste and air regulations and are compatible with other issues, particularly those which have been highlighted in the 208 water quality management plans. These management plans include recommendations for controlling sources of pollution, such as those from discharges to surface waters, from landfills, and from runoff and are used to set priorities for awarding construction grants.

This review process is being formalized to assure consistent review standards and compliance with all related regulations, both state and federal. Criteria for review of the sludge management portion of construction grants facilities plans have been drafted and will be used as a guideline by DWPC

construction grants staff, the Regional DEQE Engineers, and consultants. In addition, DWPC is preparing a construction grants project review procedures list as a part of its program to administer the grants program. This review list will specify points at which grant proposals and projects are to be reviewed by DEQE REE's and other appropriate agencies and the procedures to be followed by the construction grants staff. The 201 Criteria will be incorporated into the Review Procedure List.

b) Plans for private wastewater treatment facilities built to meet NPDES permits are submitted by DWPC Regional Engineers to the DEQE REE's for review. This review process has been more effective over the past several years as the interrelationship of various environmental programs has been more clearly defined by regulations, both at the state and federal level. However, there is no formalized system established for this review procedure. Such a system will be developed and implemented.

2) Between DWPC construction grants staff and other agency personnel through the staff sludge specialist who acts as liaison with other programs and through the Review Procedure List described above:

This Review Procedure has been developed to assure input by all appropriate agencies in the course of the development of construction grants projects. Included in the List are DEQE REE's

[see 1) a) above] and DWPC Regional Engineers who have supervisory responsibility for wastewater treatment facilities once they are operational. The review by the DWPC Regional Engineers is important because it provides a perspective gained from in-the-field experience with operating wastewater facilities.

3) Through the preparation of environmental assessment reports by the DWPC Planning Section:

This section is responsible for coordination with all agencies at various governmental levels in the preparation of environmental assessment reports required for construction grants projects. Included in these reports are comments concerning potential impacts on endangered species, prime agricultural lands, archeological and historic sites, and open space and recreational opportunities as well as on such areas as land, air, and water which are subject to other various regulatory programs.

4) Through the development of the 208 regional water quality management plans which in many cases include analysis of sludge disposal problems and recommendations for control of pollution caused by them:

The 208 program received federal grants in the fiscal year 1979 to address sludge management issues and to fund several regional programs,

including a demonstration land application project. (See Appendix D)

5) Through the 1979 State/EPA Agreement which, recognizing the importance of sludge disposal, included an item on Sludge/Septage/Solid Waste:

Some of the tasks involved in this agreement included establishment of a sludge management section within DEQE, development of land application regulations for sludge and septage disposal, development of composting regulations, inventory data concerning sludge, and availability and suitability of sites for land application.

6) Through the establishment of the inter-agency Sludge Task Force which is addressing management and regulatory issues pertaining to sludge.

In addition to these methods, coordination and cooperation will be greatly strengthened by the integration of the Division of Water Pollution Control into the Department of Environmental Quality Engineering authorized by MGL Chapter 511 of the Acts of 1980. This statute makes possible the unification of DWPC and DEQE staffs in one agency, responsible to the Commissioner of DEQE, and thereby facilitates the development, administration, and enforcement of a comprehensive sludge management policy.

5. Sludge Facts for Massachusetts

a. Amount

There are 114 publicly owned wastewater treatment facilities presently in operation in Massachusetts. Of these, 16 are in the process of upgrading their treatment level or making improvements to their plants. There are also six (6) new plants under construction and two (2) under design.

It is difficult to pinpoint the amount of sludge produced by each plant. Table A illustrates the range of quantities produced by different treatment processes. Many plants in Massachusetts, particularly the smaller ones, have no means for measuring the amount of sludge they produce, and when figures are available they are not always given in the same unit of measurement. In addition, sludge volumes can vary from month to month. However, using data from the monthly reports of POTW's to the Division of Water Pollution Control, it is estimated that more than 6,000 wet tons per day of sludge are generated in Massachusetts by municipal treatment facilities. (See Appendix E)

b. Characteristics

Sludge characteristics vary from plant to plant depending upon a variety of factors, ranging from the treatment process employed to the sources of the wastewater. Systems which treat only domestic wastes have relatively low levels of heavy metals in their sludge, whereas sludge from systems treating industrial wastes have higher levels of heavy metals and may also contain organic chemical compounds. The chemical quality

Table A

TYPICAL QUANTITIES OF SLUDGE PRODUCED BY DIFFERENT TREATMENT PROCESSES [1]

Treatment process	Normal quantity of sludge: Gal/ million gal of sewage	Wet tons/ million gal of sewage	Cu ft/ 1,000 persons daily	Moisture %	Specific gravity of sludge solids	Specific gravity of sludge	Dry Solids: Dry lb/ million gal of sewage	Dry lb/ 1,000 persons daily
Primary sedimentation:								
Undigested	2,950	12.5	39.0	95	1.40	1.02	1,250	125
Digested in separate tanks	1,450	6.25	19.0	94	--	1.03	750	75
Oigested and dewatered on sand beds	--	0.94	5.7	60	--	--	750	75
Oigested and dewaterd on vacuum filters	--	1.36	4.3	72	--	1.00	750	75
Trickling filter	745	3.17	9.9	92	1.33	1.025	476	48
Chemical precipitation	5,120	22.0	68.5	92	1.93	1.03	3,300	330
Dewatered on vacuum filters	--	6.0	19.3	72	--	--	3,300	330
Primary sedimentation and activated sludge:								
Undigested	6,900	29.25	92.0	96	--	1.02	2,340	234
Undigested and dewatered on vacuum filters	1,480	5.85	20.0	80	--	0.95	2,340	234
Oigested in separate tanks	2,700	11.67	36.0	94	--	1.03	1,400	140
Oigested and dewatered on sand beds	--	1.75	18.0	60	--	--	1,400	140
Oigested and dewatered on vacuum filters	--	3.5	11.7	80	--	0.95	1,400	140
Activated sludge:								
Wet sludge	19,400	75.0	258.0	98.5	1.25	1.005	2,250	225
Oewatered on vacuum filters	--	5.62	19.0	80	--	0.95	2,250	225
Dried by heat dryers	--	1.17	3.0	4	--	1.25	2,250	225
Septic tanks digested	900		12.0	90	1.40	1.04	810	81
Imhoff tanks, digested	500		6.7	85	1.27	1.04	690	69

[a] Based on a sewage flow of 100 gal/capita/d and 300 ppm, or 0.25 lb per capita daily, or suspended solids in sewage.

1 ft^3 = 28.32 l
1 gal = 3.785 l
1 ton = 907.2 kg
1 lb = 0.454 kg

Source: EPA, Process Design Manual, Municipal Sludge Landfills, October 1978 (EPA-625/1-78-010, SW-705), p. 3-13.

of a community's water, the presence of stormwater in a system, and the use of chemical coagulants in the treatment process are some of the major factors affecting the chemical composition of a sludge. Table B shows the typical composition of raw and digested POTW sludge and also illustrates the differences in composition which result from the use of different sludge treatment processes. The typical chemical composition of sludges is presented in Table C. At present there is little data available on the concentration of synthetic organic chemicals in municipal sludge.

Since there is no sludge quality reporting requirement in Massachusetts, there is no data available concerning the chemical composition of sludge produced by each municipal plant in the state. In 1976, the Division of Water Pollution Control funded a study of sludge from 22 municipal treatment plants in the state. Analysis was performed for eight heavy metals: cadmium (Cd), lead (Pb), mercury (Hg), nickel (Ni), chromium (Cr), copper (Cu), zinc (Zn) and arsenic (As). According to the summary of this study which appeared in The Feasibility of Application of Municipal Sewage Sludge on Agricultural Land in Massachusetts, "the highest median values were for zinc while the lowest were for cadmium" (See Table D and Figures 1 and 2). "Figures 1 and 2 are cumulative frequency distribution in which the percentage of samples having concentrations of an element less than or equal to a particular value are plotted. For instance, 40% of all samples had a nickel concentration less than or equal to 30 mg/kg on a dry weight basis, while 80% of

all samples had zinc concentrations less than or equal to 200 mg/kg on a dry weight basis."[1]

Table B
TYPICAL COMPOSITION OF RAW AND ANAEROBICALLY DIGESTED PRIMARY SLUDGES

Item	Raw Primary Sludge		Anaerobically Digested Primary Sludge	
	Range	Typical	Range	Typical
Total dry solids (TS), %	2-7	4	6-20	10
Volatile solids (% of TS)	60-80	65	30-60	40
Grease of fats (ether soluble, % of TS)	6-30	---	5-20	---
Protein (% of TS)	20-30	25	15-20	18
Nitrogen (N, % of TS)	1.5-4	2.5	1.6-6	3
Phosphorus (P_2O_5, % of TS)	0.8-2.8	1.6	1.5-4	2.5
Potash (K_2O, % of TS)	0-1	0.4	0-3	1
Cellulose (% of TS)	8-15	10	8-15	10
Iron (not as sulfide)	2-4	2.5	3-8	4
Silica (SiO_2, % of TS)	15-20	---	10-20	---
pH	5-8	6	6.7-7.5	7
Alkalinity (mg/l as $CaCO_3$)	500-1,500	600	2,000-3,500	3,000
Organic acids (mg/l as HAc)	200-2,000	500	100-600	200
Thermal content (BTU/lb)	6,800-10,000	7,600[a]	2,700-6,800	4,000[b]

Note: --- means data not shown in reference cited.

1 BTU/lb = 0.556 cal/kg

[a] Based on 65% volatile matter

[b] Based on 40% volatile matter

Source: EPA, Process Design Manual, Municipal Sludge Landfills, Oct. 1978 (EPA-625/1-78-010, SW-705), p. 3-11.

Table C
CHEMICAL COMPOSITION OF MUNICIPAL WASTEWATER SLUDGES[a]

Component	Units	Number of samples	Range	Median	Mean	Coefficient of variability, %[c]
Total N	%[b]	191	0.1-17.6	3.3	3.9	85
NH_4-N		103	0.1- 6.8	0.1	0.7	171
NO_3-N		45	0.1- 0.5	0.1	0.1	158
P		189	0.1-14.3	2.3	2.5	61
K		192	0.1- 2.6	0.3	0.4	99
Ca		193	0.1-25.0	3.9	4.9	87
Mg		189	0.1- 2.0	0.5	0.5	75
Fe		165	0.1-15.3	1.1	1.3	148
Mn	mg/kg[b]	143	18-7,100	260	380	209
B		109	4-760	33	77	162
Hg		78	0.5-10,600	5	733	232
Cu		205	84-10,400	850	1,210	138
Zn		208	101-27,800	1,740	2,790	134
Ni		165	2- 3,520	82	320	162
Pb		189	13-19,700	500	1,360	177
Cd		189	3- 3,410	16	110	157

[a] Data are from numerous types of sludges (anaerobic, aerobic, activated, lagoon, etc.) in seven states: Wisconsin, Michigan, New Hampshire, New Jersey, Illinois, Minnesota, Ohio

[b] Percent or mg/kg oven-dry solids basis.

[c] Standard deviation as a percentage of mean. Number of samples on which this is based may not be the same as for other columns.

Source: EPA, Process Design Manual, Municipal Sludge Landfills, Oct. 1978 (EPA-625/1-78-010, SW-705), p. 3-14.

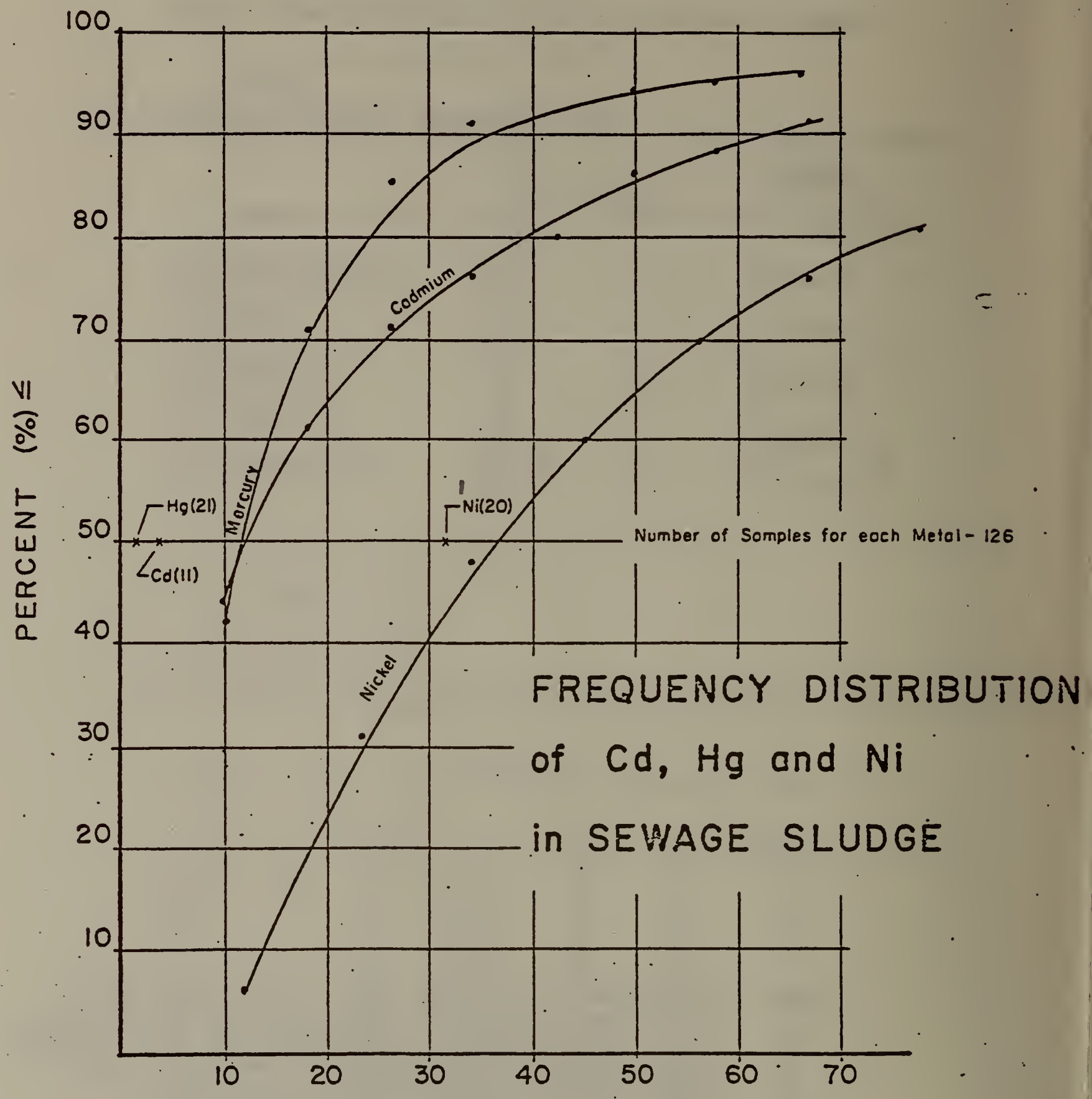
Table D

Median Concentrations of Trace Metals in Sewage Sludges

	No. of Analyses	Median (mg/kg dry weight)
Cadmium	126	11
Lead	126	380
Mercury	126	12.5
Nickel	126	26
Chromium	72	140
Copper	72	780
Zinc	72	1,140

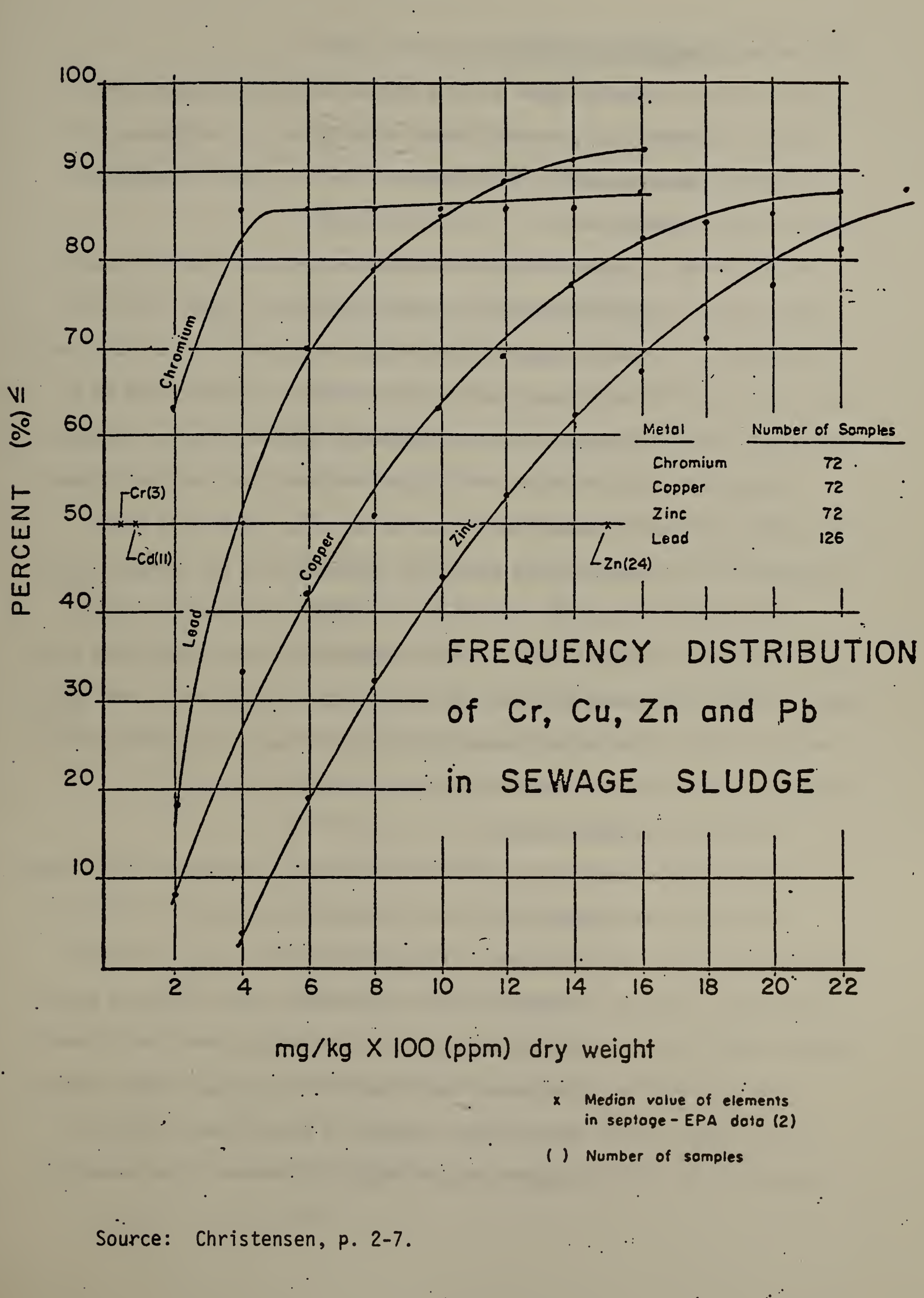
Source: Christensen, R.L., et al, 1977. "The Feasibility of Application of Municipal Sewage Sludge on Agricultural Land in Massachusetts". Report of a Task Force submitted to the Commission on Organic Waste Recycling, Executive Office of Environmental Affairs, Commonwealth of Massachusetts, published as Agricultural Experiment Station Bulletin 650, December 1977, p. 2-5.

Figure 1



Source: Christensen, p. 2-6.

Figure 2



Source: Christensen, p. 2-7.

c. Method of Disposal

Listed below are the methods of sludge disposal used by POTW's in operation, under construction, or in planning or design stages. (See Appendix F for the list of individual communities.)

1) Disposal by land application--There are four (4) plants which presently land-apply all their sludge. For all these plants, sludge is applied directly to the land as a fertilizer, and this practice has been initiated as a substitute for the originally planned disposal solution. One facility, Sturbridge, had been land applying sludge for beneficial purposes, but this practice is being discontinued because of problems with the sludge quality resulting from sludge processing inadequacies at the plant. Two (2) plants supplement their landfilling disposal with the use of sludge for fertilizer. Land application of composted sludge does not exist because there are no compost projects underway at present in Massachusetts.

2) Disposal by landfilling--91 POTW's dispose of their sludge or sludge ash by landfilling either on site or off site.

a) Off-site: 55 plants presently dispose of their sludge off site. Of these, 42 use municipal solid waste landfills; 8 use privately owned solid waste landfills; and 5 landfill in special sludge disposal facilities. Disposal in a solid waste landfill requires special handling because of the nature of

sludge, particularly when containing less than 18% solids, and as such requires authorization by the local board of health in accordance with 310CMR 19.16, Regulations for Disposal of Solid Wastes by Sanitary Landfills. Not all landfills accept sludge, and in general landfills which do accept sludge restrict it to sludge originating in their towns.

Use of solid waste landfills for disposal of sludge will become increasingly difficult as a result of the RCRA mandated program to eliminate open dumps. Landfills will have to meet the Classification Criteria set by EPA "for determining what solid waste disposal facilities and practices pose a reasonable probability of adverse effects on health or the environment."[2] Any landfill which does not meet the criteria will fall into the open dump category. DEQE will be evaluating landfills in the state to determine which meet the criteria for a sanitary landfill and which are open dumps. Since DEQE will be revising its sanitary landfill regulations to be consistent with EPA's Classification Criteria, landfills in the latter category will have to either upgrade their facilities or close down. The extent to which these regulatory actions will affect sludge disposal activities can not be estimated at this time, but there will be some impact either on the cost of disposal or on the availability of landfill sites.

b) On-site: 36 existing plants landfill their sludge on-site. Though on-site disposal facilities have been regulated under MGL Chapter 83, Section 7 as a part of the sewage treatment process, it has been DEQE policy to subject them to the same standards and regulations as sanitary landfills. Plans for such disposal facilities are approved by the DEQE Regional Environmental Engineer and also will be subject to the open dump inventory and to the new DEQE sanitary landfill regulations. These disposal facilities, therefore, will have to be consistent with Criteria for Classification and thereby will comply with the CWA regulations for sludge disposal.

3) Ocean Disposal--The only ocean disposal of sludge occurring in the state is by the Metropolitan District Commission (MDC) system at its Deer Island and Nut Island plants. Since 1971, when the MDC and DWPC signed a Memorandum of Agreement to study alternative sludge disposal methods, efforts have been underway to find a solution which would eliminate discharge into Boston Harbor. The EPA Environmental Impact Statement published in June, 1979, found incineration as the most cost-effective and environmentally safe solution but also recommended that composting, an alternative which had never been evaluated for the MDC system, be studied to determine its feasibility as an adjunct to or substitute for incineration. Before design of the sludge incinerator begins, the MDC will update its 1973 Sludge Management Study and will include

in this work an examination of the feasibility of sludge composting. It is expected that the eighteen month study will begin in January, 1981.

4) Incineration--There are 11 existing sludge incinerators in the state. Ash from these incinerators is disposed of as follows:

Existing Sludge Incinerators

Municipality	Status	Ash Disposal
Chicopee	In operation	Off-site
Fall River	Not operational; unit being refurbished	Off-site
Fitchburg	In operation	Off-site
Greater Lawrence Sanitary District	In operation	On-site
Holyoke	Not operational	Off-site
Hull	To be operational, September, 1981	Off-site
Maynard	Not operational	Off-site
New Bedford	In operation	Off-site
South Essex Sewerage District	Not operational	Possible on-site
Swampscott	In operation	Off-site
Upper Blackstone Water Pollution Abatement District	In operation	On-site

There are three sludge incinerators under design or construction. The ash from these incinerators will be disposed of as follows:

Lynn - Off-site (not specified)

Brockton - On-site

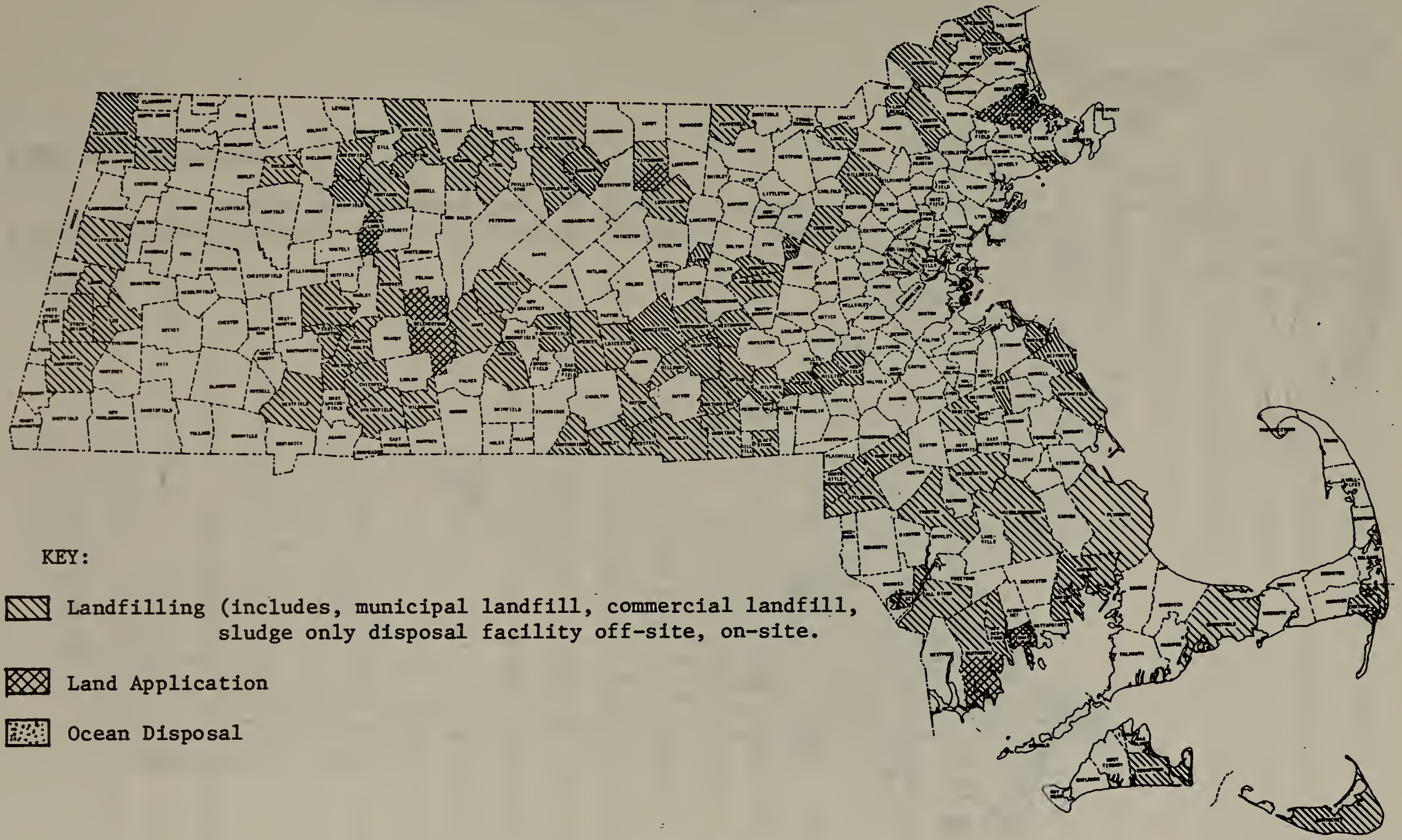
Attleboro - Off-site

Incineration has been selected as the recommended alternative for the MDC but is not yet under design.

Sludge incineration, particularly for plants producing large volumes of sludge, has been considered a practical and effective means of addressing sludge disposal problems because it reduces the weight of material to be disposed by about 80% and produces an inert waste in the form of an ash. However, in the past few years rising fuel costs and in some instances technical difficulties have caused some communities to reconsider incineration. For example, during the past few years, Fitchburg has been evaluating the feasibility of land application as an alternative to the high cost of incinerating sludge at the East Plant. In Fitchburg's case, escalating fuel costs coupled with an incinerator designed for a capacity not yet attained has produced a situation where it is inefficient to operate the facility and has caused the community to seek an alternative solution. Swampscott is another community looking for an alternative to incineration because of rising fuel costs. A pilot sludge composting facility is about to be launched in that community. Woodchips and leaves will be used as the bulking agents, and the compost will be used by the Department of Public Works for municipal uses.

d. Sludge Disposal Problems

The inability to dispose of sludge or sludge ash in an environmentally acceptable and cost-effective manner



KEY:

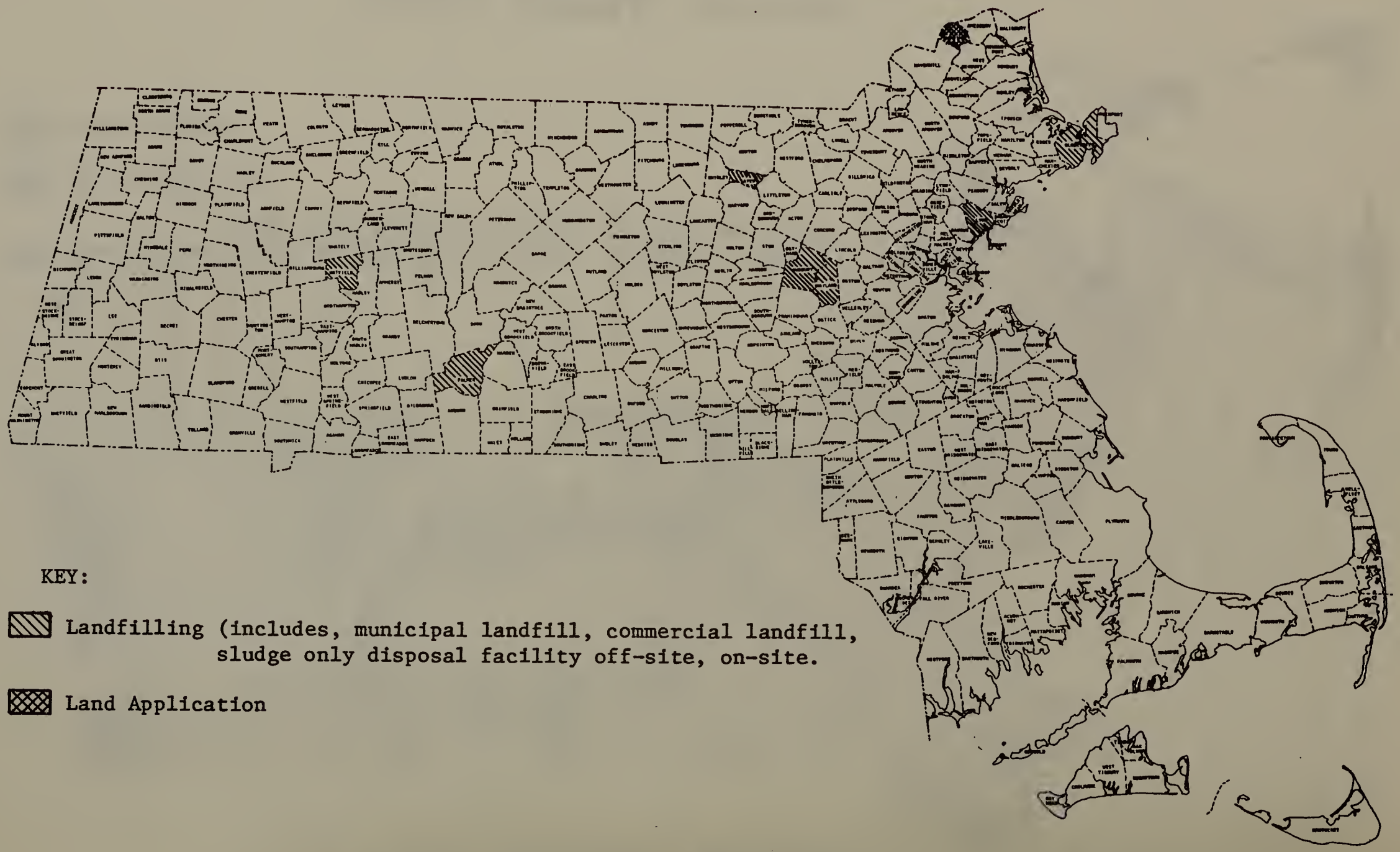
Landfilling (includes, municipal landfill, commercial landfill, sludge only disposal facility off-site, on-site.

Land Application

Ocean Disposal

SLUDGE DISPOSAL METHODS

EXISTING PLANTS



KEY:

Landfilling (includes, municipal landfill, commercial landfill, sludge only disposal facility off-site, on-site.

Land Application

SLUDGE DISPOSAL METHODS

NEW PLANTS

jeopardizes the operation of a wastewater treatment plant. The range of sludge disposal problems in Massachusetts varies from those for which alternative solutions have been readily implementable to those which have caused closure of the facility.

The reasons for the disposal problems also vary. One major reason is that at the inception of the Construction Grants Program no interrelationship existed among the water, land, and air programs and water pollution abatement decisions were made with little consideration of their impact on land and air. The time span involved in decisions and implementations of projects has also caused problems. In several instances disposal solutions which were available at the time a plan was approved no longer were feasible by the time the facility actually went into operation. Economic factors changed. Inflation and rising fuel costs have had a major impact on disposal solutions. Since POTW's have had to shoulder the full cost of operation and maintenance, many times they have been forced to alter their processes to save money. Up to 1980, federal and state funds were only available for construction activities. Chapter 510 of the Acts of 1980 provides partial relief from high operating costs by authorizing DWPC to reimburse some communities for fifty percent of the cost of certain chemicals. The uncertainties involved in the design and planning of a facility also create problems. The reliability of certain processes, the number of man hours needed, the estimated volume of sludge are some of the factors which often differ in operation from planning and which contribute to

disposal difficulties.

The following is a description of some of the disposal problems in the State:

Sunderland - Sludge drying beds do not work well enough to accommodate all sludge produced. The alternative solution presently employed is the storage of sludge in a lagoon and land application as fertilizer for corn silage.

Sturbridge - The volume of sludge produced greatly exceeds the original estimate. Sludge lagoons have been installed as supplements to the drying beds. The POTW is also considering the addition of chemical and physical dewatering methods. Old Sturbridge Village has been taking dewatered sludge from the plant for reuse but can no longer continue to do this because the sludge from the lagoons, which is mixed with sand and gravel, is of a quality unsuitable for reuse. The POTW must find alternatives for final disposition of its sludge.

Fitchburg East - Sludge incinerators have developed structural problems and also must be upgraded to meet air quality emission standards in order to receive operating

certification from the Division of Air Quality Control.

Lowell - Plant opening had been delayed by the inability to find a landfill site for sludge. Sludge temporarily is being trucked to a commercial landfill in Barre. The Barre Board of Health permit expires October 31, 1980.

Hoosac Water Quality District - Sludge from the plant has been disposed in the town landfill. However, because the sludge disposal is substantially reducing the landfill's capacity, an alternative is being sought. Land-spreading as fertilizer for corn silage is being evaluated.

South Essex Sewerage District - The plant operation has been halted because of problems with the operation of the incinerators and sludge ash disposal. As a result, untreated sewage has been discharged directly into Salem Harbor from July, 1979 and will probably continue until 1982. Odors from the incinerators created problems, and the incinerators were shut down to permit structural modifications. The landfill site originally designated for ash disposal in the facilities plan was no

longer available when the incinerators went into operation. In addition, the ash was found to contain high concentrations of hexavalent chromium, a toxic substance, further complicating the incineration process and ash disposal.

Metropolitan District Commission - Efforts have been underway for the past 9 years to find an alternative to the discharge of sludge into Boston Harbor. Technological developments and economic changes during that time span have added another 18 months work to update the original study. In addition, strong local opposition to the recommended alternative incineration has developed.

6. Conclusion

It is clear that sewage sludge management must be administered in a comprehensive manner in order to assure coordination with other regulatory and resource management programs. This is particularly important in relation to the protection of air quality and surface and ground water resources and to the encouragement of resource recovery and conservation programs.

a. Management

Responsibility for the development and administration of policy should continue to be centralized within DEQE. At present this function is being carried out by the Sludge Program Coordinator in the Division of Hazardous Waste (DHW). However,

there is a need to establish within DHW a section with responsibility for policy development and implementation for all residuals, including solid waste, sludge, and septage. At present, DHW is being organized along such lines, and it is expected that the Sludge Program Coordinator's role will be integrated with other similar functions into the section designated for policy,planning,and implementation.

Specifically the sludge management functions should include:

1) Coordinating and participating in the sludge related activities of various state agencies. Such coordination is particularly needed:

   a) with the solid waste and hazardous waste programs of DHW, with the Divisions of Water Supply and Air Quality, and with the DEQE Regional Engineers;

   b) with DWPC in review of the sludge management components of facility plans to assist in assuring that sludge disposal problems are resolved in a manner compatible with all pertinent regulations and planning programs; particular attention needs to be given to recommendations of the 208 water quality management plans, innovative and alternative technologies, pretreatment plans, and potential hazardous waste problems;

   c) with the Bureau of Solid Waste in the development of the state's Solid Waste Plan and in the implementation of the state's resource recovery policy;

d) with the Department of Food and Agriculture and the Cooperative Extension Service in development and implementation of land application projects;

2) Serving as a focal point for sludge management planning decisions;

3) Drafting and supervising the review of sludge-related regulations and guidelines, both federal and state;

a) on the state level, completing and promulgating land application and composting regulations;

b) on the federal level, monitoring the regulatory process and providing analysis on major federal policies which impact sludge and related issues;

4) Assembling and reviewing technical background information from all available sources on sludge disposal practices;

5) Assisting communities by serving as a technical information clearing house and by facilitating resolution of management problems.

b. Implementation

Policy implementation is the key to a successful management program. Such implementation needs to be carried out at both the administrative and regulatory level. On the administrative level, it is extremely important that the planning and supervision of wastewater treatment facilities, both private and public, be coordinated with other programs related to sludge management. For sludge from POTW's, that interfacing is accomplished by the coordination of the construction grants program and of the DWPC Regional Engineers with the DEQE

Regional Engineers. The coordination which presently occurs should be strengthened. A more clearly defined procedure needs to be established so that DEQE regional engineers are involved in the development of sludge management plans at a stage early enough to assure a solution which is compatible with other regulatory programs and policies and to avoid time pressures exerted by grant obligation deadlines. Responsibility for facilitating and monitoring such coordination should lie with the Sludge Program Coordinator (or the appropriate section when established in DHW).

There also needs to be clarification concerning the role of the construction grants staff and that of the DWPC regional engineers. Technically, the construction grants staff's responsibility for a wastewater treatment facility is turned over to the DWPC Regional Engineer when operation of the facility begins. However, in actuality the size of the capital investment in treatment facilities often necessitates construction grants involvement until the plant is operating smoothly. Since an unresolved sludge disposal problem can jeopardize the entire plant's operation, this sometimes means the construction grant staff's continued involvement until a satisfactory sludge disposition solution is found in order to safeguard the capital investment. It is also important that there be good communication between the DWPC Regional Engineers and the construction grants staff in order to get feedback on operational performance and reliability of various treatment processes.

Improved management should be developed for sludge generated by private wastewater treatment facilities. Hazardous sludge is

regulated under the Hazardous Waste Management Act and is subject to control through a manifest system and transport licensing program. However, it is important that communities which have pretreatment programs inform those industries with pretreatment facilities of the Hazardous Waste Regulations in order to assure that there will be no disposal problems.

A formal review mechanism should be established for disposal plans for non-hazardous sludge generated by a privately owned facility either treating wastes to comply with an NPDES permit or pretreating prior to discharge into a sewer. In the former case, DWPC approval of such facilities should be subject to an established review procedure by DEQE Regional Engineers. Sludge disposal criteria should be developed cooperatively at the DEQE Regional Offices by the environmental engineering and water pollution control staffs to assure consistency and compliance with other regulatory programs. In the case of non-hazardous sludge disposal from private pretreatment facilities, which are under the jurisdiction of communities, there is presently no formal state regulatory program which assures that sludge from these facilities is properly disposed of. One approach to this problem would be DEQE technical assistance to communities to aid them in supervising and enforcing their pretreatment programs. It also is expected that as the state's ground water policy and regulatory program is further developed, all surface disposal practices will be controlled in regard to their impact on ground water and thus all sludge, regardless of its source of generation, placed on the land would be included.

Since sludge disposal crosses the jurisdiction of several programs on both the federal and state level, it is important

that the applicable regulations among these programs be consistent. The sludge program coordinator should continue monitoring and commenting on state and federal regulatory developments to assure consistency with the state's sludge management policy and compliance with federal standards. There should also be close cooperation with MEPA staff in review of sludge related projects and the effect of MEPA regulations on sludge management.

DEQE has already taken two steps in the establishment of a uniform regulatory program. The first is the proposal to regulate sewage sludge under one statutory authorization and thus eliminate the confusion of different statutes for different disposal sites. Regulations will be revised to assure consistency with RCRA and CWA and to clarify the mechanism for local input in sludge disposal solutions. The second is the recent establishment of a special task force to address the issue of intra-departmental consistency so that regulatory enforcement is uniform across the state. Sludge disposal and utilization is included in the scope of their work. It is expected that the Task Force will conclude its study within the year.

c. Data Collection

An important aspect of program management and development is the compilation of data. At present sewage sludge data, particularly that concerning volumes and quality is difficult to obtain. In some cases the information does not exist. One solution to this problem would be to have the Division of Water Pollution Control require more specific and consistent reporting of sludge volumes in monthly plant reports and institute a sludge quality reporting system.

Such information would serve several purposes: it would assist POTW's in complying with the RCRA criteria for land disposal and application and with the CWA sludge disposal/utilization guidelines; it would provide a means of measuring the effectiveness of pre-treatment; and it would also be useful in the hazardous waste management program. It is important that such a reporting system be compatible with the other relevant data collection systems, such as for solid waste or for water quality. If such data is computerized, a program should be developed which facilitates the exchange of data among regulatory and planning programs.

d. Laboratory Analysis Capability

Determination of the quality of sludge entails laboratory analysis. Tests for heavy metals and organic chemicals require special equipment, such as an atomic absorption spectrometer and gas chromatograph and a mass spectrometer. Such equipment is expensive and requires use by trained personnel. Since most smaller POTW's will not have such analytical capabilities, it is suggested that the larger POTW's which have such equipment serve as regional facilities. Fees for such analyses as well as fuller utilization of their equipment should also have the advantage of improving the cost-effectiveness of such sophisticated equipment. The regional use of POTW laboratories would also be a means of supplementing the limited number of private laboratories with such analytical capability as well as relieving the demands on the Lawrence Experiment Station.

Since the state will also be involved with more testing for heavy metals and organic chemical compounds, it is urged that the

Lawrence Experiment Station receive funding commensurate to its expected work load. The increased demands for analysis of sludge, ground and surface water, and hazardous waste are placing an intolerable load on the Laboratory.

e. Sludge Dispoal Alternatives

It is evident that interest is developing to seek alternatives to the traditional sludge disposal methods. What are the options? The land, the air, and the water, both underground and on the surface, are environmental media which are protected from pollution, and disposal options have to be adopted which comply with environmental regulatory programs. In addition, sludge treatment processes and disposal solutions are constrained by economics and energy needs. As a result, sludge management policies should encourage the utilization of sludge's inherent resource values both as a soil nutrient and as a potential energy source.

Use of sludge as a fertilizer by direct landspreading or as a soil amendment in a composted form has many benefits and advantages, but it requires a firm regulatory and enforcement program to protect public health and the environment. DEQE and EPA both are in the process of developing regulations for the beneficial use of sludge. However, enforcement of regulations and the monitoring of land application projects is equally important to assure that there is no contamination of soil, water, or crops. DEQE will need additional resources to administer an effective enforcement program, and it also will need the cooperation and assistance of the Cooperative Extension Service whose county agents already have a close working relationship with the agricultural community.

As the industrial pretreatment programs become implemented, more sludge will be produced by POTW's with lower heavy metals and toxics and thus can be land-applied with fewer restrictions. On the other hand, there will be more industrial pretreatment facilities generating increased quantities of sludges, with high concentrations of toxics,which will require disposal or treatment at a hazardous waste facility. Processes, such as incineration, used to reduce sludge volumes should be designed wherever feasible to be energy sources rather than consumers. Starved air combustion such as pyrolysis is a developing technology which not only is more energy efficient but also produces a residue with varying potential as a fuel substance. Greater consideration needs to be given to combustion processes which generate energy, such as use of heat to produce steam to generate electricity. Combustion of sludge and solid waste together or in complementary processes is another technology which holds promise for resource recovery. Though this technology has been used in Europe, it is relatively new to the United States. There are several facilities in operation and under construction elsewhere in the country which can provide closer examples than those located in Europe. This is an area which should be pursued because of its potential for solving two disposal problems at once and for providing alternative energy sources.

Landfilling, though more strictly regulated than in the past as a result of RCRA will undoubtedly continue to be relied upon to dispose of sludge. Where sites are available, either at a POTW or elsewhere, landfilling will be no problem. However, landfilling should be resorted to only after thorough and serious evaluations of reuse alternatives in order to be consistent with the state and

federal policy of encouraging resource utilization and recovery.

In areas where siting is difficult, regional solutions should be considered. At present there are no facilities in Massachusetts established to serve as regional disposal sites for sludge produced by several POTW's. There may be some landfills which accept sludge from another community. In general, most communities are reluctant to do so. However, in built-up areas of the state, such as the Boston-northeast section, where sludge landfill siting is particularly difficult, a regional solution may be preferable. There are problems concerning regional siting and grant funding which need to be addressed. On the other hand, a regional approach would eliminate the proliferation of sludge landfills, reduce the amount of land devoted to such uses, assure better control over disposal and thus over potential pollution problems, and do away with the need to use solid waste landfills for sludge disposal.

It is important that the Legislature understand the scope of the sludge disposal managment issue because it involves so many areas of concern, such as: the construction grants program; the regulatory programs protecting water, land, and air from pollution; public health; agriculture, horticulture, and sylviculture; resource recovery; industry; and the siting of disposal facilities. All of these areas of concern are important to the Commonwealth for economic as well as environmental reasons. The Construction Grants Program alone will have brought $900 million and 45,000 jobs to Massachusetts for the period from 1972 to 1980. It is hoped that this report clarifies the issues involved with the development of an effective management program and that the Legislature, in its wisdom, will use the report as a resource tool either for future studies or for legislative decisions.

Glossary of Terms

FEDERAL ACTS AND PROGRAMS

CAA - Clean Air Act (1977 Amendments)

CWA - Clean Water Act (1977 Amendments)

RCRA - Resource Conservation and Recovery Act (1976)

SDWA - Safe Drinking Water Act (1974)

TSCA - Toxic Substances Control Act (1976)

NPDES - National Pollutant Discharge Elimination System - Permit required for discharge of any pollutant into surface waters and wetlands.

Pretreatment Program - Industries required to treat their wastewater prior to discharge into a municipal sewer system.

STATE AGENCIES AND PROGRAMS

BSWD - Bureau of Solid Waste Disposal

DAQ - Division of Air Quality

DEM - Department of Environmental Management

DEQE - Department of Environmental Quality Engineering

DFA - Department of Food and Agriculture

DHW - Division of Hazardous Waste

DWPC - Division of Water Pollution Control

EOEA - Executive Office of Environmental Affairs

EIR - Environmental Impact Report

MEPA - Massachusetts Environmental Policy Act

POTW - Publicly-Owned Treatment Works

STP - Sewage Treatment Plant

MGL - Massachusetts General Law

Footnotes

1. Elwood, John and Isaac, Russell, 'Municipal Sludge in Massachusetts', in Christensen, R.L., et al, 1977, "The Feasibility of Application of Municipal Sewage Sludge on Agricultural Land in Massachusetts", Report of a Task Force submitted to the Commission on Organic Waste Recycling, Executive Office of Environmental Affairs, Commonwealth of Massachusetts, March, 1977, published as Agricultural Experiment Station Bulletin 650, p. 2-4 (December, 1977).

2. U.S. Environmental Protection Agency, "Criteria for Classification of Solid Waste Disposal Facilities and Practices", 40 Code of Federal Regulations, Part 257, Section 1(a), September, 1979.

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Christensen, Robert L., et al, "The Feasibility of Application of Municipal Sewage Sludge on Agricultural Land in Massachusetts", Report of a Task Force submitted to the Commission on Organic Waste Recycling, Executive Office of Environmental Affairs, Commonwealth of Massachusetts, Boston, Mass., March, 1977, published as Agricultural Experiment Station Bulletin 650, December, 1977.

Light, Robert G., et al, "The Opportunities and Potential for Composting Organic Materials in Massachusetts", Report of a Task Force submitted to the Commission on Organic Waste Recycling, Executive Office of Environmental Affairs, Commonwealth of Massachusetts, October, 1977.

New England Interstate Water Pollution Control Commission, Guides for the Design of Wastewater Treatment Works, Publication Number TR-16, April, 1978.

United States Environmental Protection Agency, "Criteria for Classification of Solid Waste Disposal Facilities and Practices", 40 Code of Federal Regulations, Part 257, September, 1979.

United States Environmental Protection Agency, Environmental Research Information Center, Technology Transfer, Process Design Manual, Municipal Sludge Landfills, Report No. EPA-625/1-78-010, SW-705, October, 1978.

United States Environmental Protection Agency, Municipal Environmental Research Laboratory, Technology Transfer, Process Design Manual, Sludge Treatment and Disposal, Report No. EPA-625/1-79-011, September, 1979.

Chronological Summary of Federal Laws,
Regulations, Guidelines and Criteria Affecting Sludge

Title	Date Issued	Status	Comment
Water Pollution Control Act	10/8/72	P.L. 92-500	Sludge disposal provision limited to control of the discharge of potential pollutant to navigable waters.
New Source Review Regulations	6/18/74	Final	State permit required for new source of air pollution, including sludge incinerators, under Clean Air Act.
New Source Performance Standards	3/8/74	Final	Limits particulate emissions under Clean Air Act.
Thermal Processing and land disposal of solid waste regulations	8/14/74	Final	Replaced by criteria for classification of Solid Waste Disposal Facilities and Practices - Fed. Reg., Sept. 21, 1979.
Safe Drinking Water Act	12/16/74	P.L. 93-523	Set national standards to protect public surface and ground drinking water supplies.
Resource Conservation and Recovery Act	10/2/76	P.L. 94-580	Requires that solid waste be utilized or disposed of in a safe and environmentally acceptable manner; sludge included in definition of solid waste.
Toxic Substance Control Act	10/11/76	P.L. 94-469	Prohibits production of PCB's thereby eliminating potential source of toxic contamination of sludge.
Clean Water Act	12/77	P.L. 95-217	Amendments to P.L. 92-500; Provision for safe sludge disposal and utilization; and encouraged beneficial utilization of sludge.
Section 201(g)(5)			Requires analysis of innovative and alternative (I/A) technologies as a condition of grant. Specifies scope of I/A alternatives.
Section 201(i)			Encourages techniques reducing total energy requirements.
Section 201(j)			15% bonus for cost-effectiveness of I/A technology.
Section 202(a)(2)			85% grant for I/A technology.
Section 202(a(3)			100% grant for cost of replacement or modification of I/A technologies.

Section 204(a)(3)			Priority for grants for cost of drawings and specifications for any I/A treatment works.
Section 205(i)			2% set aside for I/A grants. One half of 1% of this for innovative technologies.
Section 307(b)(1)(a)			Pretreatment of toxic pollutants introduced into POTW tied to sludge use or disposal.
Section 403(a)			Requires promulgation of ocean discharge criteria to serve as guidelines for evaluating NPDES permits.
Sections 405(a)&(b)			Ties discharge of sludge into navigable waters to NPDES program.
Section 405(d)			Provides for establishment of regulations providing guidelines for sludge disposal and utilization.
Section 405(e)			Makes guidelines issued under 405(d) mandatory for POTW's.
Amendments to Clean Air Act	8/7/77	P.L. 95-95	Provisions for regulating point source emissions.
Amendments to Marine Protection, Research and Sanctuaries Act	1/11/77	P.L. 95-153	Prohibits disposal of sludge in ocean after 12/31/81.
Pretreatment regulations	6/26/78	Final	For new and existing sources; regulation of industrial discharges into POTW's.
Water Quality management regulations	9/7/78	Final	Issued under Sections 106, 208, and 303(a) of CWA: designed to integrate the planning, management, and implementation programs under RCRA, SDWA and CWA.
State Management Assistance Grants Regulations	9/20/78	Final	Issued under Section 205(g) of CWA to manage the Construction Grant Program.
Construction Grants Regulations	9/27/78	Final	Comprehensive construction grant regulations including cost/benefit analysis, incentives for innovative and alternative methods of treatment, and grant eligibility for land for sludge composting.
Guidelines for landfill disposal of solid waste	3/26/79	Proposed	Issued under 1008(a)(3) of RCRA; guidance document for sound landfilling practices, including landfilling of sludge.
Revision of regulations pertaining to NPDES system	6/7/79	Final Rule	Applicability to sludge management dependent upon EPA 405(d) regulation decision.

Pretreatment standards for leather industry	7/2/79	Proposed	Require pretreatment of certain pollutants discharged into POTW's by leather industry.
Guideline for development of state solid waste management plans	7/31/79	Guidelines	Concerns assigning state agency responsibility for sludge management; issued under Section 4002(b) of RCRA.
Pretreatment standards for electroplating industry	9/7/79	Final	Require pretreatment of certain pollutants discharged into POTW's by electroplaters.
Criteria for Classification of Solid Waste Disposal Facilities	9/13/79	Final; Interim Final	Regulations for sludge land disposal and land application to food chain crop issued under Sections 1008(a)(3) and 4004(a) of RCRA and under Section 405(d) of CWA.
Pretreatment standards for gum and wood chemical industries	11/29/79	Proposed	Require pretreatment of certain pollutants discharged into POTW by this industry.
Pretreatment standards for petroleum refining industries	12/21/79	Proposed	Same as above
Pretreatment standards for paint formulating industry	1/3/80	Proposed	Same as above
Pretreatment standards for ink formulating industry	1/3/80	Proposed	Same as above
Ocean discharge criteria	2/12/80	Proposed	Issued under Section 403(c) of CWA; mandatory guidelines to evaluate NPDES permit applications for ocean discharge of pollutants.
Sludge marketing and distribution regulations	5/6/80	Preproposal draft	Issued under Section 405(d) of CWA; set standards for sludge product use beyond immediate control of POTW's.
Hazardous Waste Regulations	5/19/80	Final	Issued under Section C of RCRA; POTW sludge subject to these regulations if meet EPA specified test for hazardous waste.

FINAL EPA (4004) LAND DISPOSAL CRITERIA

REQUIREMENTS FOR SEWAGE SLUDGE AND SEPTAGE

DISPOSAL AND LANDSPREADING PRACTICES

PUBLISHED: September 13, 1979

AUTHORITY: Sections 1008 and 4004 Resource Conservation and Recovery Act and Section 405 Clean Water Act

ENFORCEMENT: Section 405 (e) make compliance with the criteria mandatory for all POTW's placing sewage sludge on the land. Further guidelines may address sludge incineration, energy recovery, and the give away or sale of processed sludge.

SUMMARY OF MAJOR PROVISIONS:

Section: 257.3-1 Flood plains - Facility of practice shall not:

(a) Restrict 100 year flood

(b) Reduce temporary water storage capacity of 100 year flood plain

(c) Result in washout of solid waste during 100 year flood

257.3-2 Endangered Species - Facility or practice shall not:

(a) Cause or contribute to taking of any endangered or threatened species

(b) Result in destruction or adverse modification of a critical habitat

257.3-3 Surface Water - Facility or practice shall not:

(a) Cause discharge of pollutants to waters of the U.S. in violation of section 402 of CWA (NPDES)

1) Wetlands are considered waters of the U.S.

2) Surface runoff which is collected or channelled by man is subject to CWA section 402 (NPDES) requirements

(b) Cause discharge of dredged or fill material in violation of section 404 of CWA

(c) Cause non-point source pollution of waters of the U.S. that violates legal requirements of 208 water quality management plan

257.3-4 Groundwater

(a) Facility or practice shall not contaminate underground drinking water source beyond solid waste boundary

(b) State with EPA approved solid waste management plan may establish alternative boundary based on analysis of factors listed in this section of the criteria.

- Groundwater contamination occurs when:

  - Leachate from facility causes groundwater beyond solid waste boundary to exceed maximum contaminant levels (MCL's) of primary drinking water standards.

  - Causes increase in levels addressed above where background levels already exceed MCL's.

  - Criteria protect both current and future uses of groundwater.

  - A proposed amendment to the CWA would add National Secondary Drinking Water Standards to the definition of contamination.

257.3-5 Application to Land Used for Food-Chain Crops:

- Governs sludge application within 1 meter of surface (root zone).

(a) Two approaches for Cadmium control:

(1) a. pH of solid waste - soil mixture $\geq$ 6.5 at time of application. Sludges with less than 2 mg/kg (dry weight) Cd exempt.

b. Annual application doesn't exceed .5 kg/ha on land used for leafy vegetables or root crops, for other food-chain crops Cd application rates are specified.

c. Maximum cumulative Cd rates are specified according to soil cation exchange capacity and background soil pH.

(2) Food-chain crop produced is animal feed:

a. Soil-solid waste mixture pH $\geq$ 6.5 at time of application or planting whichever is later.

b. Facility operating plan shows how feed will be distributed and what safeguard measures will be taken to prevent health hazards from Cd in food-chain.

c. Future property owners are notified in land record or property deed that land received high application rates of Cd etc.

(b) PCB's - Solid waste with PCB's $\geq$ 10mg/kg (dry wt.) must be incorporated into soil when applied to land used for producing animal feed, including pasture crops for animals raised for milk. Incorporation is not required if PCB's content in feed $\leq$ .2 mg/kg (actual wt.) or $\leq$ 1.5mg/kg (fat basis) in milk.

- This section is "interim final" which means that the regulation is final and legally enforceable;however, EPA is seeking further comments.

257.3-6 Disease

(a) Disease Vectors must be minimized through periodic application of cover material or other appropriate techniques.

(b) Sewage sludge and septic tank pumpings; (Interim Final)

(1) a. Sewage sludge must be applied to land surface or incorporated into soil treated by process to significantly reduce pathogens prior to application.

b. Public access to facility must be controlled for 12 months.

c. Grazing by animals whose products are consumed by humans must be prevented for at least one month.

(2) Septic tank pumpings applied to land surface or incorporated into soil must be treated by a process to significantly reduce pathogens prior to application unless public access is controlled and grazing by animals whose products are consumed by humans is prevented for one month.

(c) (1) Sewage sludge or septic tank pumpings applied to land surface etc. must be treated by process to further reduce pathogens if the crop is for direct human consumption and is grown within 18 months of application.

(2) Above not required if no contact exists between edible portion of crop and solid waste or if crops are for direct human consumption and are not grown within 18 months of application. In those cases the conditions outlined in (b) (1) & (2) must be satisfied.

- The above provisions do not apply to sewage sludge or septage disposed of by trenching or burial.

257.3-7 Air

(a) Facility shall not engage in open burning.

(b) Facility shall not violate applicable requirements of the approved state implementation plan.

257.3-8 Safety

(a) Explosive Gases (methane) shall not exceed:

1. 25% lower explosive limit in facility structures.

2. Lower explosive limit in soil at property boundary.

(b) Fires - Facility shall not pose a hazard to safety or property from fires. This may be accomplished by periodic application of cover etc.

(c) Facility disposing of putrescible wastes that may attract birds and occurs within 10,000 feet of a runway used for turbojet aircraft or within 5,000 ft. runway used only by piston-type aircraft shall not pose a bird hazard to aircraft.

(d) Access - Facility shall not allow uncontrolled public access so as to expose the public to potential health and safety hazards at the disposal site.

Major EPA Publications on Sludge

Air Pollutions Aspects of Sludge Incineration, Technology Transfer Seminar Publication, June, 1975, EPA-625/4-75-009

Application of Sewage Sludge to Cropland: Appraisal of Potential Hazards of the Heavy Metals to Plants and Animals, Office of Water Programs Operations, November 15, 1976, EPA-430/9-76-013

Municipal Sludge Management: Environmental Factors, Technical Bulletin, Office of Water Program Operations, October, 1977, EPA-430/9-77-004

Innovative and Alternative Technology Assessment Manual, Office of Water Program Operations, 1978, February, 1980, EPA -430/9-78-009

A Study of Forced Aeration Composting of Wastewater Sludges, Municipal Environmental Research Laboratory, June, 1978, EPA-600/2-78-057

Sludge Treatment and Disposal, Technology Transfer Publication, October, 1978, EPA-625/4-78-012

Municipal Sludge Landfills Process Design Manual, Transfer Technology Publication, October, 1978, EPA-625/1-78-010 SW-705

Sludge Treatment and Disposal Process Design Manual, Transfer Technology, Municipal Environmental Research Laboratory, September, 1979, EPA-625/1-79-011

EVELYN F. MURPHY
SECRETARY

The Commonwealth of Massachusetts

Executive Office of Environmental Affairs
100 Cambridge Street
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December 6, 1977

As part of the Executive Office of Environmental Affairs' commitment to resource recovery and water conservation, we have developed the following principles to guide sludge management in the Commonwealth. We believe that these principles should play an integral role in the development of water quality and solid waste programs.

SLUDGE MANAGEMENT PRINCIPLES

Sludge management decisions can affect the quality of land, air, and water as well as public and animal health. All available options for sludge management must be considered with the following principles used as the foundations for evaluation.

1. Sewage sludge can be a hazardous material, but it also can be a valuable recoverable resource. In order to contribute to energy and resource conservation, sludge technologies which reuse or recycle sludge should be favored whenever feasible.

2. Sludge must be managed in a manner which safeguards both the environment and the public health.

3. Methods of sludge management must be cost beneficial as well as environmentally acceptable.

4. Wherever feasible, land application of sludge and other organic wastes, with or without composting should be given serious consideration.

5. The use of energy intensive methods of disposal should be discouraged.

6. Whenever economically, environmentally, and technically feasible disposal of sludge should be integrated with disposal of solid waste.

Massachusetts Laws and Regulations Relating to Sludge

I. Massachusetts Constitution

Article 97	People's right to clean air, water, and healthy environment; 2/3 majority vote of legislature required for change in land use for public lands.

II. Massachusetts General Laws

Chapter	Purpose
Ch. 16, sections 18-24	State definition of solid waste made consistent with RCRA definition, including "sludge from a waste treatment plant". General authorization for BSWD solid waste management.
Ch. 21, sections 26-53	DWPC enabling legislation, including [section 27(a)] authorization for regulations for waste treatment "facilities".
Ch. 21A, section 2(13)	Authority for EOEA to develop programs relating to reclamation of solid waste and water and sewer use.
Ch. 21C	DEQE authority for regulating hazardous waste.
Ch. 21D	Siting procedure for hazardous waste facilities.
Ch. 83, section 1	Town or local authorization for sewer construction.
section 6	Authorization, with DEQE approval and public hearing, for land acquisition for sewage treatment plants either by purchase or by eminent domain.
section 7	DEQE authority to order a sewage treatment plant to enlarge or improve its works or change its method of operation, when deemed necessary to prevent pollution, nuisance, or other objectionable results.
Ch. 111, section 150A	Authorization for DEQE rule promulgation and revision re: sanitary landfills. No landfill establishment permitted without local board of health designation and public hearing re: any by-laws established pursuant to MGL Ch. 40A, General DEQE review/oversight authority.
Ch. 111, section 17	DEQE authority for sewage disposal.

Chapter	Purpose
Ch. 111, sections 142A-J	DEQE authority to promulgate regulations to prevent pollution or contamination of atmosphere.
Ch. 111, section 150B	Site assignment for hazardous waste facilities.
Ch. 111, section 160	DEQE authority to promulgate regulations to prevent pollution of and to protect drinking water supplies.
Ch. 131, section 40	DEQE authority to protect wetlands; local Conservation Commission authority for enforcement.

III. State Regulations and Policy Statements

Title	Date/Status	Comment
Title 5; pursuant to MGLA Ch. 21A, sec. 13	Current	General subsurface disposal regulation.
Wetlands protection regulations	Being drafted	Promulgation expected within the year.
DEQE Policy and Procedures Manual for Solid Waste Program	January 5, 1979	B(2) Drinking Water Supply review for sites near wells, and Section K - Disposal of Sludges at Sanitary Landfills.
DEQE Regulation, the Disposal of Solid Wastes by sanitary landfill	310 CMR 19.00 April 21, 1971	Published pursuant to MGL Ch. 111, sec. 150A.
MDC regulations	April 24, 1978	General regulations for influent into MDC sewer system.
MDC industrial permit system	Study initiated August 3, 1978	Pursuant to contract with Black and Veatch, Inc. 30 month time limit for the development of the system.
DEQE Regulation for Solid Waste Transfer Station	310 CMR 18.00 January 10, 1980	Sewage excluded from definition of refuse.
Regulations for the land application of sludge and septage.	Proposed/Draft	Being developed in conjunction with Guidelines.
DWPC regulations for STP maintenance and control	Current	Pursuant to MGL Ch. 21, sec. 27(g) authorization for regulations for waste treatment "facilities".

Title	Date/Status	Comment
Criteria for Sludge Management Component 201 Plans	Draft	Guidance for DWPC and DEQE Regional Engineers in evaluation of facilities planning.
Massachusetts Environmental Policy Act Regulations	January 25, 1979	E.I.R. overview; see esp. p. 56 of MEPA regs. - secs. 10:32 (3)b 3(b) 10:32 (3)b 5(d) 10:32 (3)b 6(b-f) also 10:32 5(a) 29-31; STP and Solid Waste facility inclusion or exclusion from review.
208 areawide water quality managment plans	Completed	See esp. sludge and residuals management sections.
DWPC Procedural Outline for Construction Grants Projects	Draft 7/80	Sets forth format for review and approval of major grants activities and actions.

DEQE REVISED PROPOSAL FOR FY'80 208 FUNDS
SLUDGE/SEPTAGE/SOLID WASTE RELATIONSHIPS

Description of the Issue/Purpose of the Project

The Resource Conservation and Recovery Act (RCRA) and the Clean Water Act recognize that the management of sludge, septage, and solid waste requires a comprehensive integrated approach.

The planning, regulation, and management of sludge, septage, and solid waste is fragmented among a number of agencies and divisions within the Executive Office of Environmental Affairs. A similar fragmentation also exists within EPA. In order to address effectively the issue of residuals management and disposal in Massachusetts, it is necessary to undertake a comprehensive review of existing disposal practices; the present institutional system for planning, regulation, and management of these materials; and a review of the laws,guidelines, regulations, and policies that exist for each material. Such activities are necessary to understand and, hopefully, implement a program that addresses the interrelationships of these materials.

Land application of septage and sludge can be a viable option for disposal and reuse of these residual wastes. Where agricultural land is available, the nutrients contained in septage and sludge can be utilized for their fertilizer value while at the same time they can be rendered harmless to the environment. The results of several successful pilot projects in Massachusetts will be used to develop a comprehensive program of septage and sludge application to agricultural land. Specifically, the sludge application projects in Sturbridge, Colrain, Erving, and Sunderland as well as the septage application project in Gill are demonstrating the viability of land applying these residual wastes.

The nature of this work plan will require input from a variety of agencies within EOEA. In particular, the DEQE Division of Hazardous Waste and the Division of Water Pollution Control will contribute staff resources to undertake the outputs called for in the work plan. However, the major responsibility for implementation of this work plan, EPA liaison, and to insure that the outputs are produced on time in a coordinated manner, will be undertaken by the DEQE Planning Division.

All reports and outputs listed in the work plan will be prepared as DRAFT material on the dates listed. This material will be subject to the appropriate agency review and public participation. It is expected that the outputs will be finalized within 4-6 weeks subsequent to the date they are prepared in draft form. All the outputs associated with this work plan will be stored in the DEQE planning office library and will be available to the public.

Project Duration

This project will commence in September 1, 1980 and terminate in September 1, 1981.

Public Participation

The public will be actively involved in the work associated with this project. The Statewide Policy Advisory Committee will be consulted and involved as well as the Water Resources Commission and appropriate environmental groups, such as the Massachusetts Audubon. Ten percent of the funding associated with this project will be devoted to public participation.

Budget

EPA Share $26,000. Non-Federal Match $8,666. Total $34,666.

Work Plan

1. September 30, 1980 - Preparation of a chart that lists key individuals within the State and Federal Government who work on sludge, septage and solid waste issues. Their reponsibilities will be noted along with their addresses, agency affiliation, and telephone numbers. This publication, which will contain a brief introduction concerning sludge, septage, and solid waste, will be printed and distributed to the public and will include a list of approved projects in Massachusetts that employ innovative or alternative sludge, septage, or solid waste disposal techniques, including co-disposal.

2. December 1, 1980 - Compilation of data from the pilot sludge and septage projects underway in Old Sturbridge Village, Sunderland, Gil, Erving, and Colrain. A report summarizing this data will be prepared.

3. December 30, 1980 - Review and analysis of the information and material generated by the Surface Water Impoundments Program. A report indicating the interrelationship of this program to sludge, septage, and solid waste issues will be prepared.

4. February 1, 1980 - Based on the compilation of site specific data on the pilot sludge and septage projects, a report will be prepared that analyzes this information and evaluates the impacts of these projects. This report will be presented to the DWPC so that they can review this data and use the report's conclusions to encourage communities to apply for and use the 201 construction grants alternative and innovative set aside funds for sludge and septage projects.

5. April 1, 1981 - Preparation of draft composting regulations.

6. July 1, 1981 - Preparation of an integrated and comprehensive policy on sludge, septage, and solid waste. This policy will be based, in part;

on the report listed in item four above and on the information contained in the State Solid Waste Management Plan. Subsequent to the endorsement of this policy, its implementation will need to be monitored and funded. Therefore, an element recognizing the importance of these residuals and requesting a specific commitment of manpower and funding will be prepared for inclusion in the various Fiscal Year 1982 Grant Applications the Commonwealth submits to EPA. This material will be incorporated in the DEQE Program Plan. Concurrent with the preparation of this policy will be the establishment of a residuals management section or sections within DEQE.

7. August 30, 1981 - Preparation of final composting regulations.

Ongoing - Review of the outputs related to sludge, septage, and solid waste that will be produced by other divisions within DEQE. Close coordination with the project managers for these projects will be maintained.

Review of appropriate grant applications, plans, and demonstration projects related to sludge, septage, and solid waste.

Coordination with work undertaken by the DEQE sludge coordinator located in the DEQE Division of Hazardous Waste.

Review of certified elements of 208 water quality management plans and the continued planning and implementation undertaken by 208 agencies for their impact on the elements contained within this work plan.

Coordination with the Division of Water Pollution Control and municipalities to encourage the utilization of the rural and alternative and innovative set-asides eligible for funding through the construction grants program.

Coordination with the Division of Air Quality on air quality regulations for sludge incineration.

Coordination with Soil Conservation Service for soil monitoring purposes on crop applied sludge.

Estimated Sludge Volumes
for Majority of POTW's in Massachusetts
(Based on best available data)

Town	Wet-Tons/Day
Adams	6.00
Amesbury	.34
Amherst	2.50
Attleboro	7.80
Barnstable	1.10
Billerica	3.36
Bridgewater	1.10
Brockton	1.00
Charles River Water Pollution Control District	.13
Chatham	.01
Chicopee	28.30
Cohasset	.29
Dartmouth	4.26
Dudley	28.50
Easthampton	2.60
Erving Center	.92
Erving-Millers Falls	.93
Fairhaven	1.01
Fall River	5.73
Fitchburg (East)	5.70
Fitchburg (West)	22.50
Gardner	23.02
Grafton	1.16
Great Barrington	33.70
Greater Lawrence Sanitary District	20.00
Greenfield	4.46
Hadley	4.17
Haverhill	20.16
Holyoke	6.90
Hoosac Water Quality District	70.20
Hudson	2.67
Ipswich	.35
Lee	6.95
Leominster (Old Plant)	4.17
Leominster (New Plant)	13.20
Lowell	10.00
Marlboro (East)	3.90
Marlboro (West)	.81
Maynard	.68
MDC-Deer Island	3566.20*
MDC-Nut Island	1200.05*
Milford	4.00
Millis	.08
Montague	87.40

Town	Wet-Tons/Day
Nantucket	.02
New Bedford	2.85
Newburyport	5.66
Northampton	70.55
North Attleboro	2.15
Northbridge	1.50
Orange	.40
Pittsfield	121.35
Rockland	.16
Scituate	.18
Shrewsbury	.58
Southbridge	19.80
South Essex Sewerage District	200.00
South Hadley	20.30
Springfield	264.00
Taunton	7.90
Templeton	15.90
Westborough	.04
Westfield	2.65
Wilbraham	16.60
Winchendon	16.70
Upper Blackstone Water Pollution Abatement District	6.00
Total	5983.60

* Digested sludge discharged into Boston Harbor; when alternative sludge disposal method is implemented, sludge quantity will be reduced as a result of dewatering.

Sludge Disposal Methods

POTW's in Operation

Municipality	Disposal Method #
Adams	ML
Amesbury	CL
Amherst	ML
Athol	ML
Attleboro	FS
Barnstable	ML
Belchertown	LA
Billerica	CL
Bridgewater	OS
**Brockton	OS
Buckland	ML
Charlton	Trucked away by septage hauler
Charles River WPCD	OS
Chatham	ML
Chicopee	CL
Cohasset	NA
Concord	OS
Dartmouth	ML/LA
Deerfield	Wasted to the river
Old Deerfield	ML
Douglas	OS
Dudley	OS
Easthampton	OS
Edgartown	OS
Erving(Center)	ML
Erving(Farley)	To Erving Center POTW for treatment
Erving(Millers Falls)	ML
Fairhaven	LA
**Fall River	ML
Falmouth	No sludge generated
East Fitchburg	ML/LA
West Fitchburg	ML
Foxborough	NA
Gardner	ML
Grafton	ML
Great Barrington	CL
Greater Lawrence Sanitary District	OS
Greenfield	ML
Hadley	To Amherst POTW for treatment
Hardwick(Gilbertville)	CL
Hardwick(Wheelwright)	CL
Haverhill	ML
Holyoke	CL-Granby
Hoosac WQD	ML-Williamstown
*Hopedale	OS
*Hudson	ML
Hull	CL
Huntington	To Westfield POTW for treatment
Ipswich	LA

Municipality	Disposal Method #
Lee	OS
Leicester	OS
**Leominster	ML
Lenox(Center)	OS
Lenoxdale	To Lenox Center POTW for treatment
Lowell	ML
Manchester	FS
*Mansfield	OS
Marion	OS
Marshfield	ML
East Marlboro	OS
West Marlboro	To E. Marlboro for disposal
Maynard	OS
MDC-Deer Island	OD
MDC-Nut Island	OD
MDC-Clinton	ML
Medfield	OS
Middleborough	ML
*Milford	OS
Millbury	ML
Millis	OS
Monroe	NA
**Montague	ML
Nantucket	OS
New Bedford	FS
**Newburyport	FS
**North Attleboro	OS
North Brookfield	OS
**Northampton	ML
Northbridge	OS
Northfield	OS
Orange	ML
Oxford-Rochdale	OS
Pepperell	OS
Pittsfield	OS
Plymouth	ML
**Rockland	ML
Rockport	Step 2/3 grant pending for sludge handling facility
Royalston	Trucked out by septage hauler
Russell	NA
Scituate	OS
Shrewsbury	ML
Somerset	ML
South Essex Sanitary District	NA
**South Hadley	ML
Southbridge	ML
Spencer	OS
Springfield-Bondis Island	ML
*Stockbridge	ML
Sturbridge	Has been land applied, future in question
Sunderland	LA
Swampscott	ML
Taunton	OS
Templeton-Baldwinville	FS
Upper Blackstone WPAD	OS
Upton	ML
Uxbridge	OS

Municipality	Disposal Method #
*Ware	ML
Wareham	OS
*Warren	ML
Webster	ML
Westborough	OS
Westfield	ML
Wilbraham	To Chicopee POTW for treatment
Winchendon	OS

New POTW's in Planning or Design Stages

Municipality	Disposal Method #
Hatfield	OS
Sudbury/Wayland	FS

New POTW's Under Construction

Municipality	Disposal Method #
Ayer	OS
Gloucester	ML
Lynn	CL (To be designated)
Mansfield(Regional)	Under Study
Merrimac	LA
Palmer	ML

* Existing plants with upgrading work in planning or design stage

** Existing plants with upgrading work under construction

Symbol/Key

CL - Commercial Landfill
FS - Sludge only disposal facility off site
LA - Land Application
ML - Municipal Landfill
NA - Information not Available
OD - Ocean Dumping
OS - On site